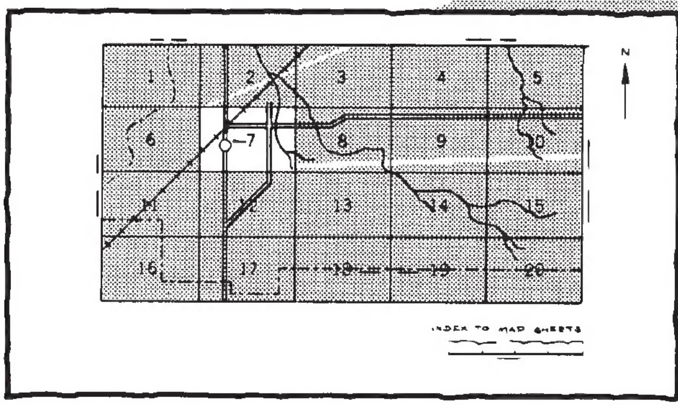
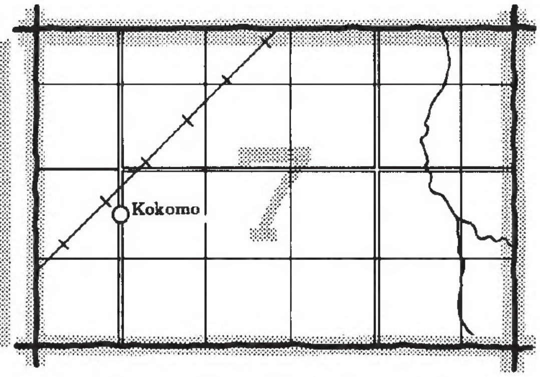
SOIL SURVEY OF
CEDAR COUNTY, IOWA

United States Department of Agriculture, Soil Conservation Service
in cooperation with the
Iowa Agriculture and Home Economics Experiment Station, the
Cooperative Extension Service of Iowa State University, and the
Department of Soil Conservation, State of Iowa

HOW TO USE

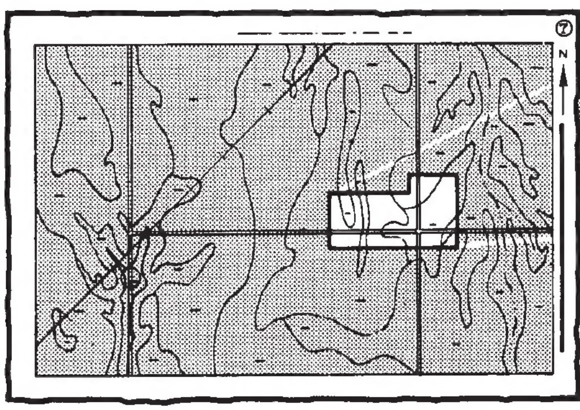
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

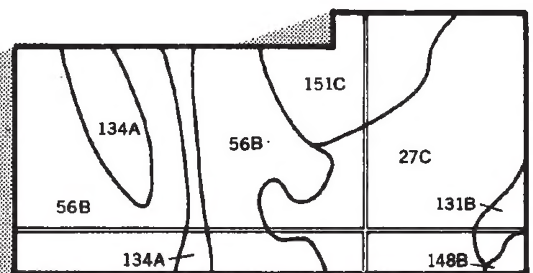




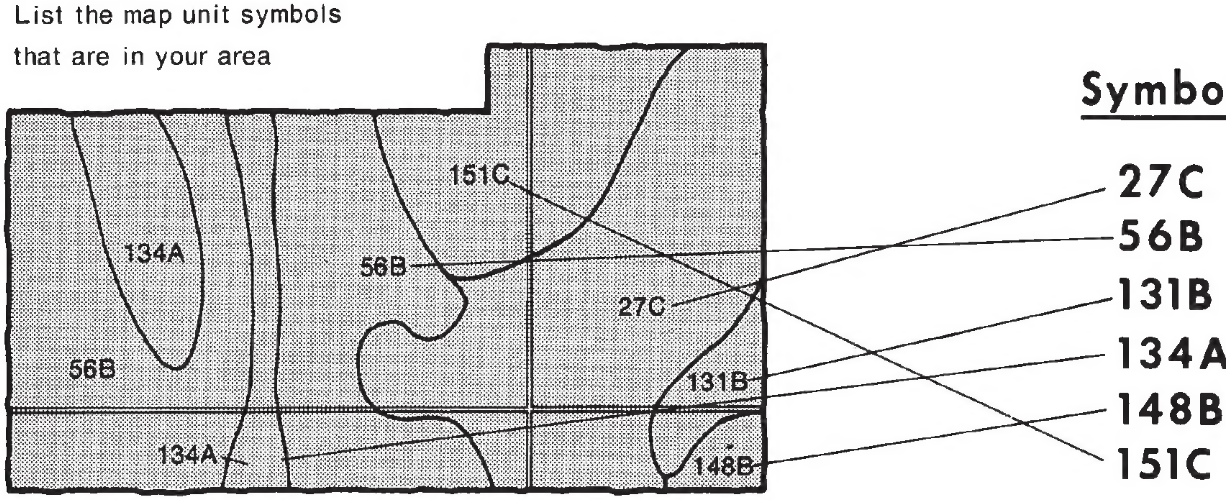
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



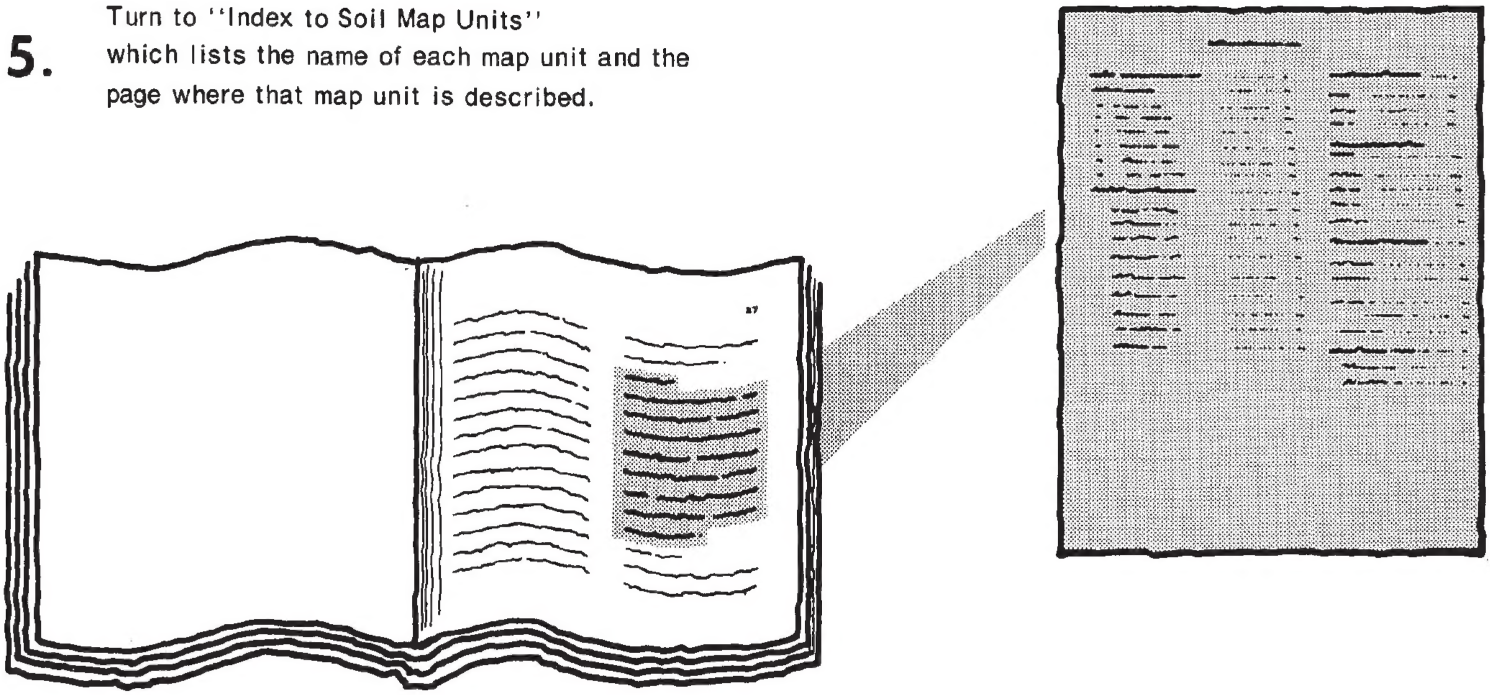


4. List the map unit symbols that are in your area

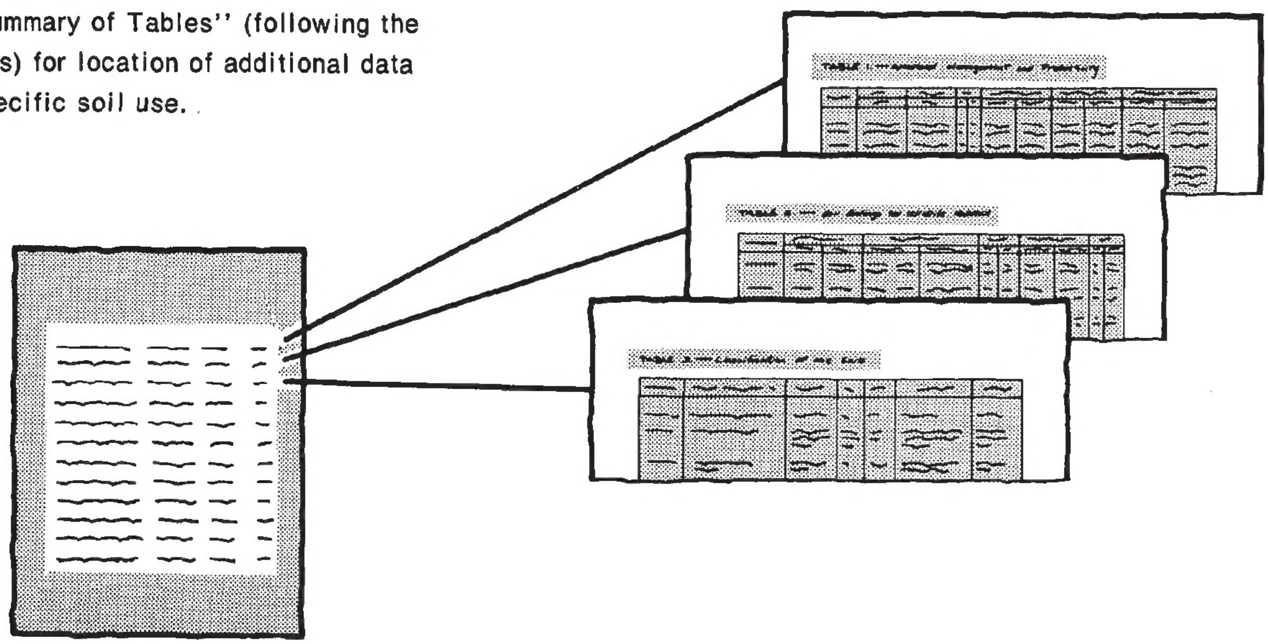


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; for specialists in wildlife management, waste disposal, or pollution control.

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1969-74. Soil names and descriptions were approved in 1975. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1975. This survey was made cooperatively by the Soil Conservation Service; the Iowa Agriculture and Home Economics Experiment Station and Cooperative Extension Service, Iowa State University; and the Department of Soil Conservation, State of Iowa. It is part of the technical assistance furnished to the Cedar County Soil Conservation District. Cedar County and the State of Iowa provided some of the funds for this survey.

Soil maps in this survey may be copied without permission, but any enlargement of these maps can cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Cover: Contour stripcropping on Downs silt loam, 5 to 9 percent slopes, moderately eroded.

Contents

Issue December 1979

Index to map units

Index to map units—Continued

Summary of tables

Summary of tables—Continued

Preface

The Soil Survey of Cedar County, Iowa, contains much information useful in land-planning programs in the county. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

This soil survey has been prepared for many different users. Farmers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.

SOIL SURVEY OF CEDAR COUNTY, IOWA

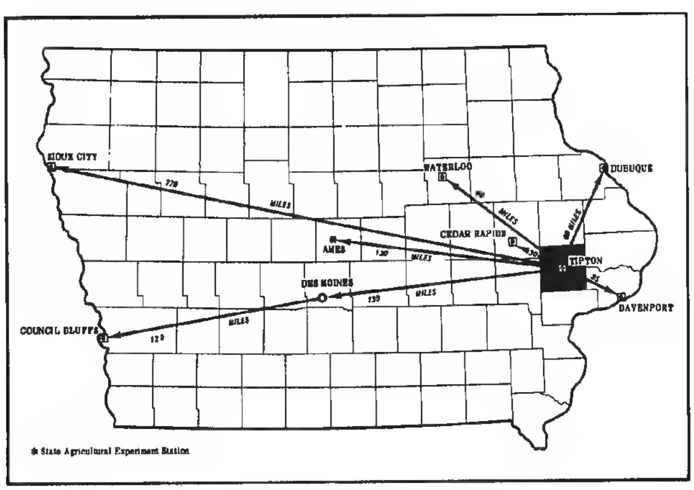
By Edward J. Schermerhorn, Soil Conservation Service, assisted by Lacy I. Harmon, Soil Conservation Service, and F. F. Riecken and T. E. Fenton, Iowa Agriculture and Home Economics Experiment Station

Fieldwork by H. H. Bright, C. M. Call, W. D. Frederick, Edward J. Schermerhorn, and N. D. Williamson, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, in cooperation with the Iowa Agriculture and Home Economics Experiment Station, the Cooperative Extension Service of Iowa State University, and the Department of Soil Conservation, State of Iowa

Cedar County is in the east-central part of Iowa. It has an area of 374,400 acres. In 1970, the population was 26,050. Tipton, which is in the center of the county, is the county seat. The largest town in the county, it had a population of 2,877 in 1970.

The county is in the Middle Western Upland Plains of the Central Lowlands. It is drained by two large streams that carry water southeastward toward the Mississippi River. The Cedar River, the principal stream, and its tributaries drain three-fourths of the county. The Wapsipinicon River and its tributaries drain the northeastern quarter of the county.



Location of Cedar County in Iowa.

Generally, the landscape is characterized by low relief and a gently undulating surface, especially in the uplands. The greatest relief is along the Cedar and Wapsipinicon Rivers, where the landscape generally is rough and hilly. In many areas the valley walls are cliffs. In some areas, however, the flood plains along the rivers are about a mile wide. The highest altitude, in the northwest corner of the county, is about 960 feet. The lowest altitude, in the south-central part where the Cedar River crosses the county boundary, is about 630 feet.

General nature of the county

The following paragraphs provide general information concerning the county. They describe settlement, farming, transportation facilities, and climate.

Settlement

Cedar County was formed from part of Dubuque County in 1837. It was first settled about 6 years before it was established. A trading post was operated along the Cedar River near the mouth of Rock Creek. The early inhabitants came from the neighboring states to the east.

Farming

Although the trend in recent years has been toward a decrease in the number of farms in the county, the size of individual farms generally has increased. The county

had a total of 1,481 farms in 1974, according to the 1974 Assessors Annual Farm Census of Iowa. In the same year, about 352,867 acres was farmland and the average size of the farms was 238 acres.

Farming is the main economic enterprise. The principal crops are corn, soybeans, oats, and hay and pasture. Beef cattle, hogs, and dairying are the principal sources of income. Livestock farms far outnumber all other types. Except for soybeans and some corn, the crops are fed to the livestock on the farms where the crops are grown. Some corn is sold as a cash crop, but the amount varies from year to year, depending largely on the price of feeder cattle, the market for hogs, the cash price for corn, and the quality of the corn crop. Although corn is the principal grain crop, the acreage in soybeans has increased in the last few years.

Transportation facilities

Federal, state, and county highways provide routes for auto traffic and for the transportation of farm products. U.S. Highway 30 and Interstate 80 cross the county from east to west and Iowa Highway 38 from north to south. The many gravel and asphalt county roads enable farmers to come to the trading centers throughout the year. Bus transportation is available for many parts of the county. Railroads or motor freight lines serve every trading center in the county.

Climate

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Tipton, Iowa, for the period 1952 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 23 degrees F, and the average daily minimum temperature is 14 degrees. The lowest temperature on record, which occurred at Tipton on January 12, 1974, is minus 25 degrees. In summer the average temperature is 72 degrees, and the average daily maximum temperature is 84 degrees. The highest recorded temperature, which occurred on July 27, 1955, is 103 degrees.

Growing degree days, shown in table 2, are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, 26 inches, or 68 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 21 inches. The heaviest 1-day rainfall during the period of record was 4.58 inches at Tipton on November 17, 1952. Thunderstorms occur on about 47 days each year, and most occur in summer.

Average seasonal snowfall is 31 inches. The greatest snow depth at any one time during the period of record was 18 inches. On the average, 19 days have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 81 percent. The percentage of possible sunshine is 68 in summer and 46 in winter. Average windspeed is highest, 12 miles per hour, in April.

Climatic data in this section were specially prepared for the Soil Conservation Service by the National Climatic Center, Asheville, North Carolina.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land-use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary

during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, among them farmers, managers of woodland, engineers, planners, developers and builders, home buyers, and those seeking recreation.

General soil map for broad land-use planning

The general soil map at the back of this publication shows, in color, the soil associations in this survey area. Each association has a distinct pattern of soils and of relief and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one association differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

1. Fayette-Downs association

Gently sloping to very steep, well drained upland soils formed in silty material

This association consists of gently sloping and moderately sloping soils on connected ridgetops and strongly sloping to very steep soils on side slopes. It is dissected by drainageways and streams, which form fingerlike networks throughout the association. Limestone crops out in a few areas, especially adjacent to the major streams. The soils formed in loess that is more than 40 inches thick.

This association occupies about 24 percent of the county. It is about 70 percent Fayette soils, 5 percent Downs soils, and 25 percent minor soils (fig. 1).

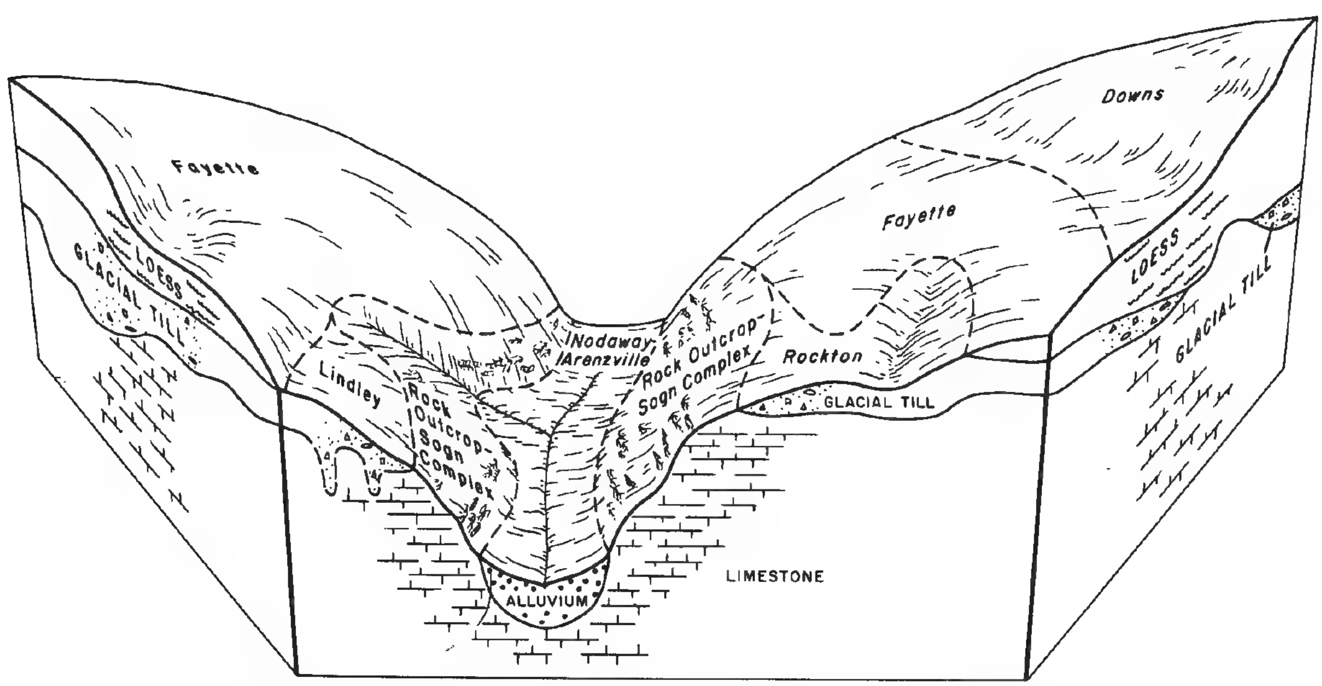


Figure 1.—Pattern of soils and underlying material in the Fayette-Downs association.

Fayette soils are gently sloping and moderately sloping on ridgetops and moderately sloping to very steep on side slopes. Typically, the surface layer is very dark grayish brown silt loam about 5 inches thick. The subsurface layer is dark grayish brown and dark brown silt loam about 6 inches thick. The subsoil is dark brown, yellowish brown, and dark yellowish brown, friable silty clay loam about 47 inches thick. The substratum to a depth of about 68 inches is yellowish brown silt loam.

Downs soils, which are dominantly on the ridgetops and are less prevalent on the side slopes, are gently sloping to strongly sloping. Typically, the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is about 38 inches thick. It is dark brown, friable silt loam in the upper part and multicolored, friable silty clay loam in the lower part. The substratum to a depth of about 71 inches is mottled light brownish gray and yellowish brown silt loam.

The minor soils in this association are the Arenzville, Chelsea, Lamont, Lindley, Nodaway, Rockton, and Sogn soils. Rock outcrop is evident in some areas. The Arenzville and Nodaway soils are along streams and waterways. The moderately steep and steep Chelsea, Lamont, Rockton, and Sogn soils are adjacent to streams. The Lindley soils occupy the side and base of steep slopes. The Rock outcrop occurs as very steep areas along rivers and streams.

Many of the areas on ridgetops and some of the areas on side slopes are cultivated. Corn and soybeans are the main row crops. Alfalfa, red clover, and bromegrass are the main forage crops. Because of the slope, a large part of this association is permanent pasture or woodland.

The gently sloping areas of Downs and Fayette soils are suited to row crops, but the steeper areas are subject to erosion. The steeper Fayette soils are better suited to permanent pasture or woodland. The main concerns of management are controlling water erosion and maintaining tilth and fertility.

2. Tama-Downs association

Gently sloping to strongly sloping, well drained upland soils formed in silty material

This association consists of gently sloping soils on broad upland ridgetops and moderately sloping and strongly sloping soils on long side slopes that are dissected by many drainageways. These soils formed in loess that is more than 40 inches thick.

This association occupies about 21 percent of the county. It is about 35 percent Tama soils, 28 percent Downs soils, and 37 percent minor soils (fig. 2).

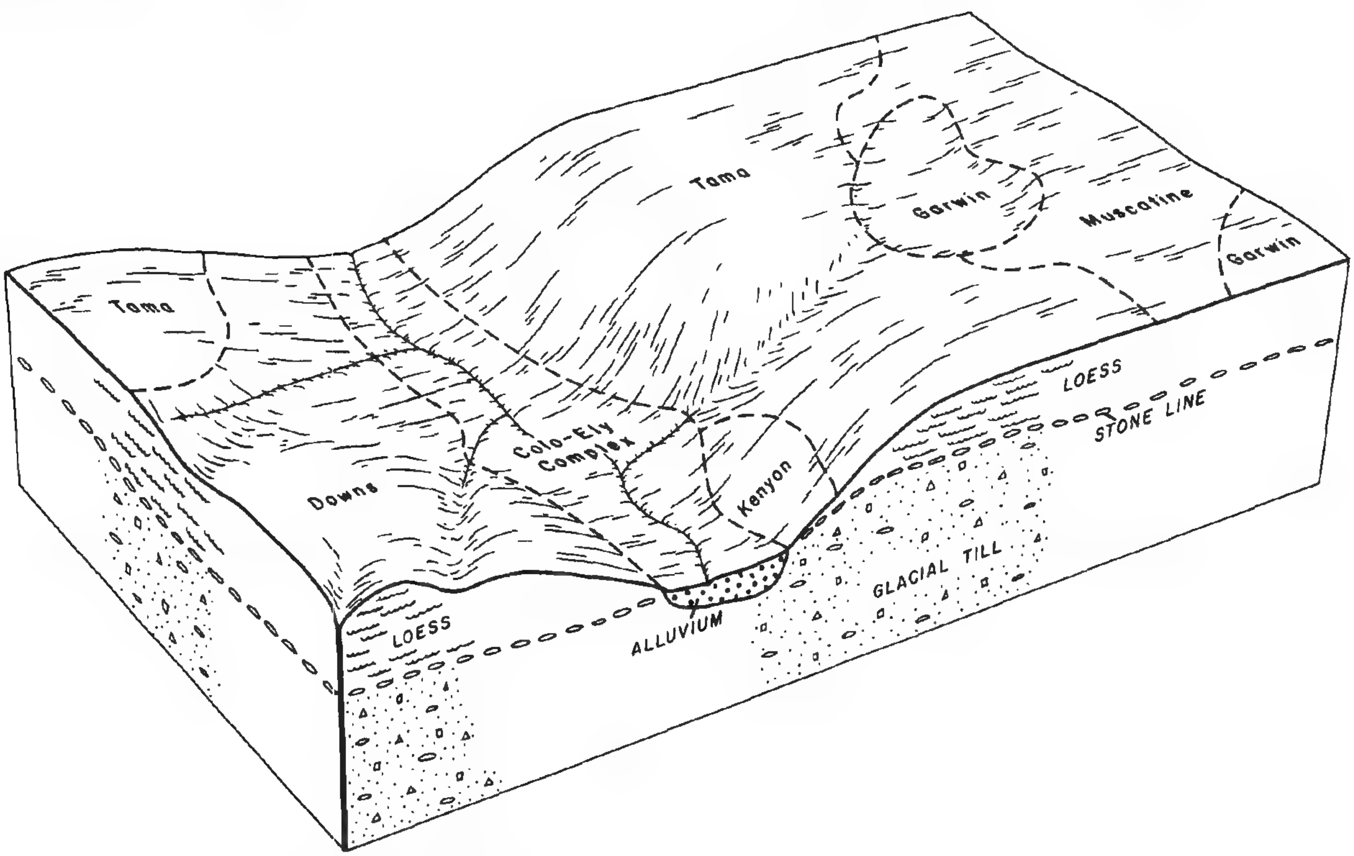


Figure 2.—Pattern of soils and underlying material in the Tama-Downs association.

Tama soils are gently sloping on the broad ridgetops and dominantly are moderately sloping on the side slopes. Less commonly, they are strongly sloping on the side slopes. Typically, the surface layer is very dark brown silt loam about 6 inches thick. The subsurface layer is very dark brown silty clay loam about 7 inches thick. The subsoil is dark brown, dark yellowish brown, and yellowish brown silty clay loam about 32 inches thick. The substratum to a depth of about 60 inches is yellowish brown silt loam.

Downs soils generally are moderately sloping and strongly sloping. They occupy side slopes adjacent to the gently sloping Tama soils on broad ridgetops. The strongly sloping Downs soils also occupy side slopes below the moderately sloping Tama soils. The surface layer is typically very dark gray silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is about 38 inches thick. It is dark brown, friable silt loam in the upper part and multicolored, friable silty clay loam in the lower part. The substratum to a depth of about 71 inches is mottled light brownish gray and yellowish brown silt loam.

The minor soils in this association are the Atterberry, Colo, Ely, Garwin, Judson, Kenyon, and Muscatine soils. The Atterberry and Garwin soils are nearly level on upland flats and gently sloping at the head of drainageways and the base of slopes. The nearly level Colo soils are in drainageways. The gently sloping Ely and Judson soils are on foot slopes directly above the drainageways. The Kenyon soils are on convex side slopes below the Tama soils. The nearly level to gently sloping Muscatine soils are on upland flats.

Corn and soybeans are grown intensively on this association. The gently sloping Tama soils are well suited to row crops. The more sloping Tama and Downs soils are more susceptible to erosion than the gently sloping Tama soils. Generally, they are eroded and contain less organic matter than the gently sloping Tama soils. The main concerns of management are controlling water erosion (fig. 3) and maintaining tilth and fertility.

Figure 3.—Erosion on Downs soils.

3. Tama-Muscatine association

Nearly level to moderately sloping, well drained and somewhat poorly drained upland soils formed in silty material

This association consists of nearly level to gently sloping soils on broad upland ridgetops and gently sloping and moderately sloping soils on side slopes. The waterways throughout this association are smooth and broad. The soils formed in loess that is more than 40 inches thick.

This association occupies about 27 percent of the county. It is about 56 percent Tama soils, 13 percent Muscatine soils, and 31 percent minor soils (fig. 4).

Tama soils are gently sloping on broad upland ridgetops and moderately sloping on side slopes. They are well drained. Typically, the surface layer is very dark brown silt loam about 6 inches thick. The subsurface layer is very dark brown silty clay loam about 7 inches thick. The subsoil is dark brown, dark yellowish brown, and yellowish brown silty clay loam about 32 inches thick. The substratum to a depth of about 60 inches is yellowish brown silt loam.

The nearly level and gently sloping Muscatine soils are on broad upland ridgetops. They are somewhat poorly drained. The surface layer is typically black silt loam about 8 inches thick. The subsurface layer is black and very dark brown silty clay loam about 10 inches thick. The subsoil is about 30 inches thick. It is very dark grayish brown to grayish brown silty clay loam mottled with yellowish brown. The substratum to a depth of about 60 inches is light brownish gray silt loam mottled with yellowish brown and strong brown.

The minor soils in this association are the Atterberry, Colo, Ely, Garwin, Sperry, and Walford soils. The Atterberry soils are nearly level on upland flats and gently sloping at the head of drainageways and the base of slopes. The Colo and Ely soils are in drainageways and on foot slopes. The nearly level Garwin soils are in depressions at the head of drainageways and on broad upland flats. The nearly level Sperry and Walford soils are in depressions and isolated potholes.

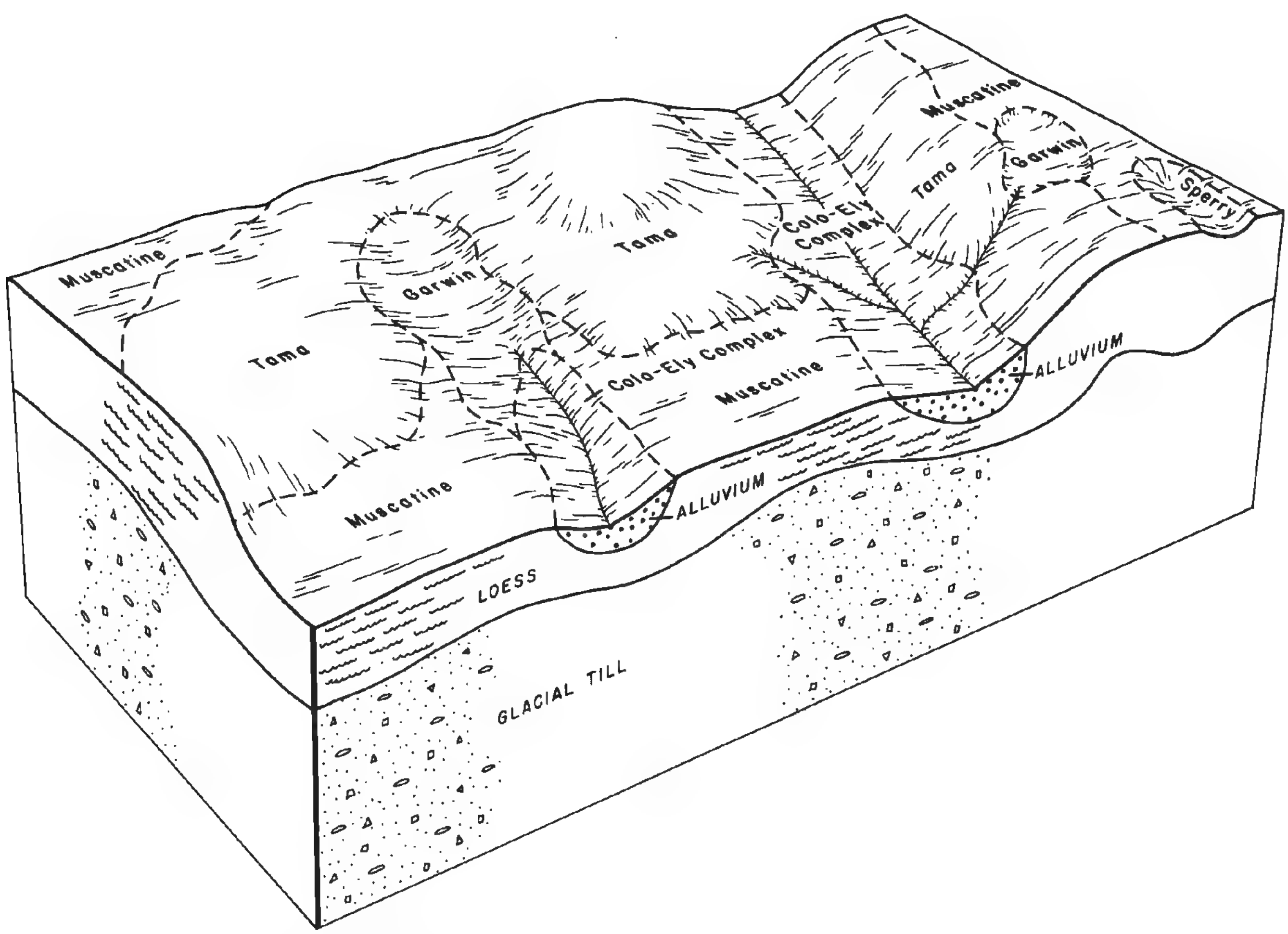


Figure 4.—Pattern of soils and underlying material in the Tama-Muscatine association.

The major soils are well suited to row crops. Corn and soybeans are grown intensively. The main concerns of management are controlling water erosion and maintaining tilth and fertility. Tile is needed in some of the more poorly drained areas.

4. Dinsdale-Klinger association

Nearly level to moderately sloping, well drained to somewhat poorly drained upland soils formed in silty material and in the underlying glacial till

This association consists of nearly level and gently sloping soils on upland flats and gently sloping and moderately sloping soils on convex upland ridges and side slopes (fig. 5). These soils formed in loess and glacial till. The loess is 24 to 40 inches thick.

This association occupies about 14 percent of the county. It is about 30 percent Dinsdale soils, 25 percent Klinger soils, and 45 percent minor soils (fig. 6).

Dinsdale soils are gently sloping on ridgetops and moderately sloping on side slopes. They are well drained and moderately well drained. Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is about 7 inches of very dark grayish brown silt loam and silty clay loam. The subsoil is about 45 inches thick. It is dark brown and dark yellowish brown silty clay loam over yellowish brown loam glacial till that contains some stones and pebbles. The substratum to a depth of about 70 inches is yellowish brown, mottled loam.

The nearly level and gently sloping Klinger soils are on upland flats or in slightly concave areas downslope. They are somewhat poorly drained. Typically, the surface layer is black silt loam about 9 inches thick. The subsurface layer is very dark brown and very dark grayish brown silty clay loam about 9 inches thick. The subsoil is about 29 inches thick. The upper part is dark grayish brown or grayish brown silty clay loam mottled with light olive brown; the lower part is mottled yellowish brown and grayish brown loam glacial till that contains some stones and pebbles. The substratum to a depth of about 60 inches is mottled yellowish brown and light brownish gray loam.

Figure 5.—A typical area of the Dinsdale-Klinger association.

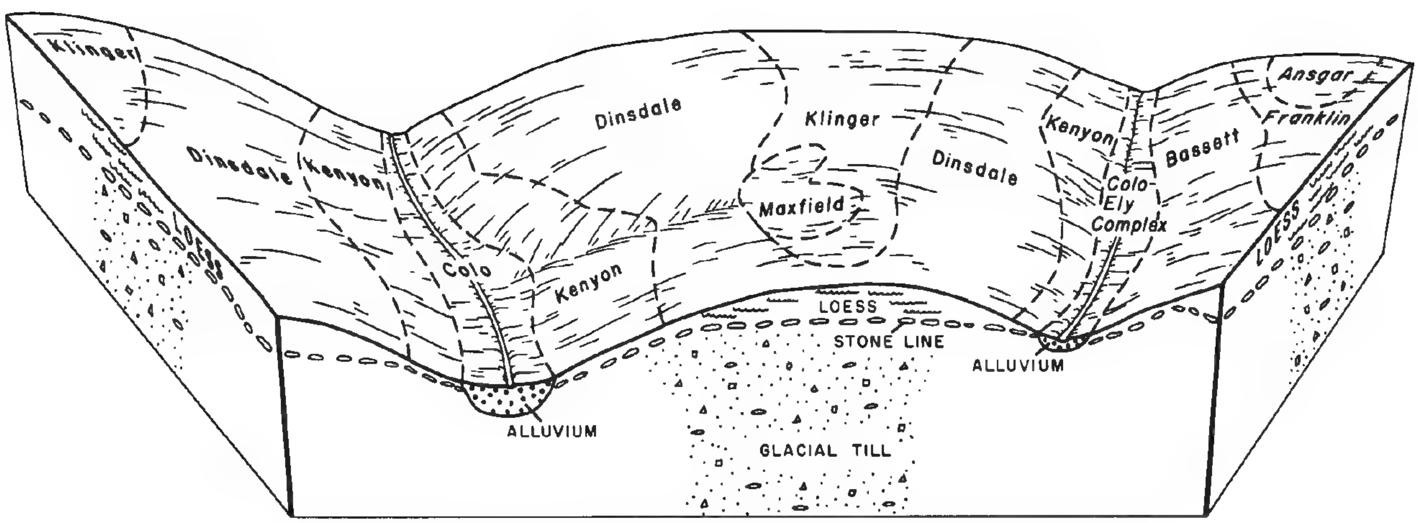


Figure 6.—Pattern of soils and underlying material in the Dinsdale-Klinger association.

The minor soils in this association are the Ansgar, Bassett, Colo, Ely, Franklin, Garwin, Kenyon, Maxfield, and Waubeek soils. The Ansgar soils are in depressions and at the head of drainageways. The Bassett and Waubeek soils are on convex ridges and side slopes. The Colo soils are in upland drainageways and along streams. The Ely soils are in upland drainageways. The Franklin soils are on flats and at the base of slopes and the head of drainageways. The Garwin and Maxfield soils are in flat areas on uplands or are in broad drainageways. The Kenyon soils are on convex ridgetops and side slopes.

The major soils are well suited to row crops. Corn and soybeans are grown intensively. The main concerns of management are controlling water erosion and maintaining tilth and fertility. Tile is needed in some of the more poorly drained areas.

5. Chelsea-Lamont-Fayette association

Moderately sloping to very steep, well drained to excessively drained upland soils formed in silty or sandy material

This association consists of moderately sloping to very steep silty and sandy soils mainly along the bluffs and breaks of the major rivers. The landscape is dunelike.

This association occupies about 2 percent of the county. It is about 30 percent Chelsea soils, 25 percent Lamont soils, 25 percent Fayette soils, and 20 percent minor soils.

The moderately sloping to very steep Chelsea soils are on upland ridges and side slopes. They are excessively drained. Typically, the surface layer is very dark gray and very dark grayish brown loamy fine sand about 5 inches thick. The subsurface layer is dark grayish brown, very dark grayish brown, dark brown, and yellowish brown, loose fine sand about 43 inches thick. Below this to a depth of about 62 inches is yellowish brown fine sand that has bands of brown sandy loam about 1 inch thick.

The moderately sloping to very steep Lamont soils are on upland ridges and side slopes. They are well drained. The surface layer is typically dark grayish brown fine sandy loam about 6 inches thick. The subsurface layer is dark grayish brown sandy loam about 3 inches thick. The subsoil is about 28 inches thick. The upper part is dark brown, brown, or strong brown loam or sandy loam, and the lower part is strong brown loamy sand. The substratum to a depth of about 65 inches is light yellowish brown fine sand and sand.

Fayette soils are moderately sloping on ridgetops and moderately sloping to very steep on side slopes. They are well drained. Typically, the surface layer is very dark grayish brown silt loam about 5 inches thick. The subsurface layer is dark grayish brown and dark brown silt loam about 6 inches thick. The subsoil is dark brown to yellowish brown silty clay loam about 47 inches thick. The substratum to a depth of 60 inches or more is yellowish brown silt loam.

The minor soils in this association are the Brady, Dickinson, Sparta, Walford, and Waukegan soils. The Brady and Walford soils are in pothole depressions or drainageways. The Dickinson, Sparta, and Waukegan soils are on ridgetops and side slopes.

The sandy soils in this association are droughty and susceptible to soil blowing and water erosion. Most of the areas are woodland or pasture. A few areas are planted to soybeans and corn. The main concerns of management are water erosion, soil blowing, and fertility.

6. Atterberry-Muscatine-Tama Variant association

Nearly level to gently sloping, somewhat poorly drained and moderately well drained upland soils formed in silty material

This association consists of nearly level to gently sloping soils on flats and in depressions in the uplands. The landscape is characterized by slight rises, depressions, potholes, and broad flats (fig. 7). The soils formed in loess that is more than 40 inches thick.

This association occupies about 2 percent of the county. It is about 30 percent Atterberry soils, 20 percent Muscatine soils, 15 percent Tama Variant soils, and 35 percent minor soils (fig. 8).

The nearly level to gently sloping Atterberry soils are on upland flats and at the head of drainageways. They are somewhat poorly drained. Typically, the surface layer is very dark brown silt loam about 9 inches thick. The subsurface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is silty clay loam about 32 inches thick. The upper part is brown and grayish brown and is mottled with yellowish brown and strong brown, and the lower part is multicolored. The substratum to a depth of about 62 inches is mottled light brownish gray, yellowish brown, and strong brown silt loam.

The nearly level to gently sloping Muscatine soils are on broad flats. They are somewhat poorly drained. The surface layer is typically black silt loam about 8 inches thick. The subsurface layer is black and very dark brown silty clay loam about 10 inches thick. The subsoil is silty clay loam about 30 inches thick. The upper part is very dark grayish brown or dark grayish brown and has yellowish brown mottles; the lower part is mottled dark grayish brown, grayish brown, yellowish brown, and strong brown. The substratum to a depth of about 60 inches is light brownish gray silt loam mottled with yellowish brown and strong brown.

The Tama Variant is on slight rises, some of which are only 1 foot to 3 feet higher than the surrounding areas. It is moderately well drained. Typically, the surface layer is very dark brown and dark brown silt loam about 15 inches thick. The subsoil is about 32 inches thick. The upper part is yellowish brown silty clay loam that has light gray and white silt coatings; the lower part is mottled grayish brown and strong brown silty clay loam or

Figure 7.—A typical area of the Atterberry-Muscatine-Tama Variant association.

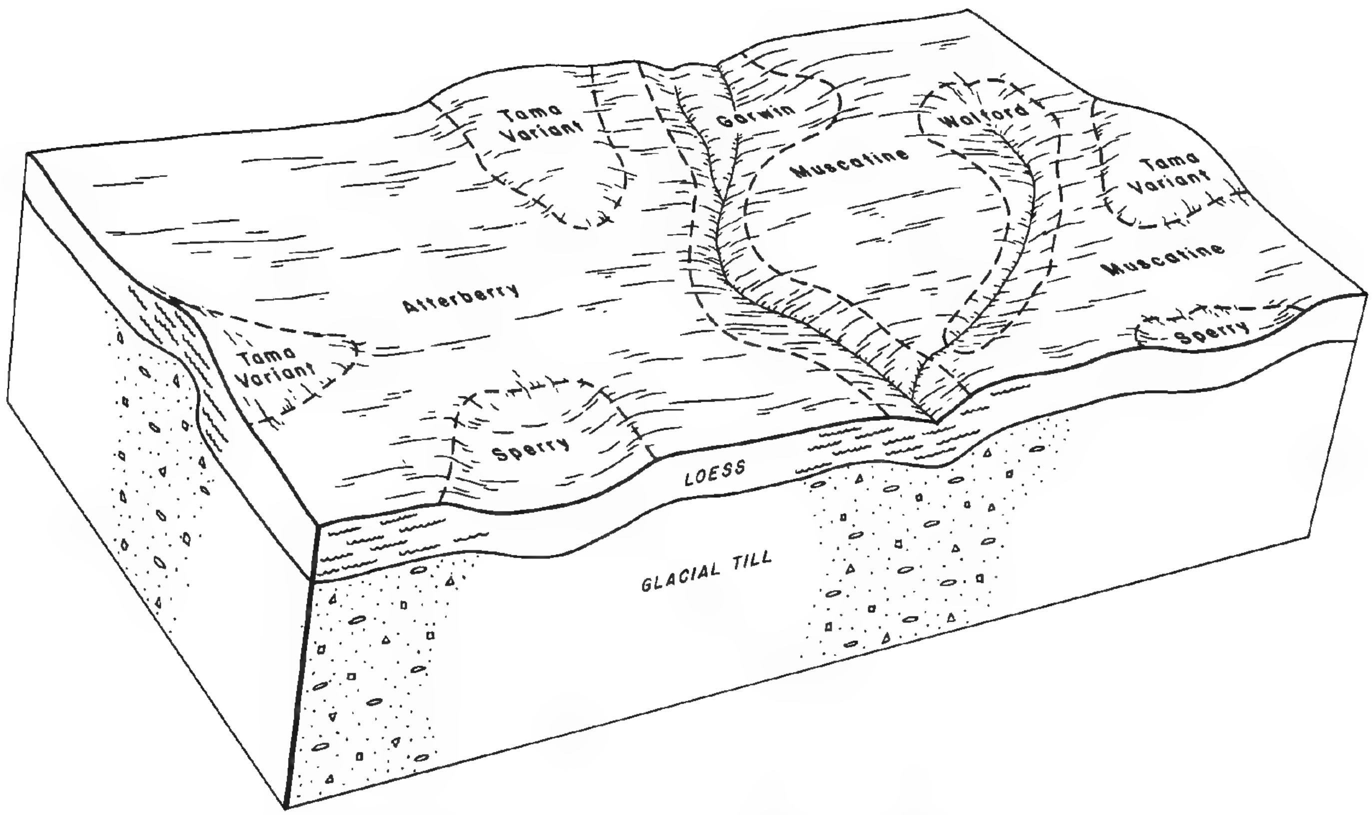


Figure 8.—Pattern of soils and underlying material in the Atterberry-Muscatine-Tama Variant association.

silt loam that has light gray and white silt coatings. The substratum to a depth of about 60 inches is mottled light brownish gray and yellowish brown silt loam.

The minor soils in this association are the Garwin, Sperry, and Walford soils. The Garwin soils are in slightly depressed areas on upland flats. The Sperry soils are in potholes. The Walford soils are on upland flats and in potholes.

The major soils are well suited to row crops. Corn and soybeans are grown intensively. Tile drainage is beneficial in the Atterberry and Muscatine soils, which are not so well drained as the Tama Variant. The main concerns of management are improving drainage and maintaining fertility.

7. Colo-Sawmill-Loamy alluvial land association

Nearly level, poorly drained to well drained bottom land soils formed in silty or loamy alluvium

This association consists of nearly level soils on bottom land and stream benches (fig. 9). Along the major rivers, the landscape is characterized by many levels of terraces and different kinds of alluvial material. In most river valleys, it is broad, flat bottom land. Except for scattered abandoned channels and oxbows, the bottom land is continuous. In some areas along the major rivers, a first bottom and many stair-step stream benches are evident.

This association occupies about 10 percent of the county. It is about 30 percent Colo soils, 20 percent Sawmill soils, 5 percent Loamy alluvial land, and 45 percent minor soils.

Colo soils are poorly drained. They formed in silty alluvium. Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black and very dark gray silty clay loam about 35 inches thick. The substratum to a depth of about 60 inches is olive gray silty clay loam mottled with olive brown.

Sawmill soils are poorly drained. They formed in silty alluvium. Typically, the surface layer is black silty clay loam about 9 inches thick. The subsurface layer is black and very dark gray silty clay loam about 24 inches thick. The subsoil is olive gray and dark gray silty clay loam about 12 inches thick. It is mottled with yellowish brown. The substratum to a depth of about 60 inches is light olive gray silt loam mottled with strong brown.

The Loamy alluvial land occurs as areas of clayey to sandy material that was deposited by streams. It is commonly flooded. This light to dark colored soil material ranges from well drained to poorly drained. Water often remains ponded in the oxbows and the remnants of former stream channels that dissect this land. In places

Figure 9.—A typical area of the Colo-Sawmill-Loamy alluvial land association.

the landscape is depressed or channeled and has natural levees that formed during periods of flooding.

The minor soils in this association are the Arenzville, Chelsea, Dickinson, Hanlon, Kennebec, Nodaway, Radford, Richwood, Saude, Sparta, Spillville, Waukegan, and Whittier soils. The Chelsea, Dickinson, and Sparta soils are on intermediate and high bench terraces. The Hanlon, Arenzville, Kennebec, Nodaway, Radford, and Spillville soils are on flood plains or first bottoms. The Saude soils are on intermediate bench terraces. The Richwood, Waukegan, and Whittier soils are on high bench terraces.

Many areas along streams and rivers are pasture or woodland. Flooding and a high water table are problems if these areas are cropped. Areas on high and intermediate bench terraces are cropped to corn and soybeans. Some areas are sandy and droughty. The main concern of management is the flooding along the bottoms and on some of the low terraces. Also, the soils on the higher bench terraces receive runoff and silt from surrounding uplands.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have profiles that are almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. The Muscatine series, for example, was named after a town in Muscatine County.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, ero-

sion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Tama silt loam, 2 to 5 percent slopes, is one of several phases within the Tama series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Colo-Ely complex, 2 to 5 percent slopes, is an example.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Some survey areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Rock outcrop is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 4, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

8B—Judson silt loam, 2 to 5 percent slopes. This gently sloping, well drained or moderately well drained soil is on alluvial fans or foot slopes. Individual areas are long or irregularly shaped and range from 5 to 40 acres in size.

Typically, the surface layer is about 8 inches of very dark brown silt loam over 20 inches of very dark brown and very dark grayish brown silty clay loam. The subsoil is dark yellowish brown, friable silty clay loam about 23 inches thick. It is mottled with yellowish brown and light gray in the lower part. The substratum to a depth of about 61 inches is yellowish brown, friable silt loam mottled with light brownish gray. Some small areas are moderately sloping.

Permeability is moderate, and available water capacity is high. Surface runoff is medium. The content of organic matter is 4.0 to 5.0 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction varies in the surface layer as a result of local liming practices. The subsoil has a low supply of available phosphorus and available potassium. Tilth is good.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard, however, if cultivated crops are grown. Minimum tillage helps to prevent excessive soil loss. Diversion terraces are needed in some areas to protect the soil against runoff from higher lying adjacent soils. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIe.

11B—Colo-Ely complex, 2 to 5 percent slopes. This map unit consists of gently sloping soils along small streams and narrow upland drainageways. Areas are irregular in shape and range form 25 to 225 acres in size. They are about 50 percent Colo soils, 30 percent Ely soils, and 20 percent other soils. The poorly drained Colo soils are nearer the stream channels or waterways and are bordered by bands of the somewhat poorly drained Ely soils. They are subject to flooding.

Included with these soils in mapping are the well drained or moderately well drained Judson soils, which are above the Colo and Ely soils on the landscape.

Typically, the Colo soil has a surface layer of black and very dark gray silty clay loam about 43 inches thick. The substratum to a depth of about 60 inches is olive gray, firm silty clay loam mottled with olive brown.

Typically, the Ely soil has a surface layer about 25 inches thick. It is very dark brown silt loam in the upper 8 inches and black and very dark grayish brown silty clay loam in the lower 17 inches. The subsoil is silty clay loam about 23 inches thick. The upper part is dark grayish brown and has a few dark brown mottles; the next part is olive brown and has a few yellowish brown mottles; the lower part is light olive brown and grayish brown and has yellowish brown and strong brown mottles. The substratum to a depth of about 63 inches is light olive brown silt loam mottled with strong brown and grayish brown.

These soils are moderately permeable. Available water capacity is high. The content of organic matter is 5.0 to 7.0 percent in the surface layer of the Colo soil and 5.0 to 6.0 percent in the surface layer of the Ely soil. Reaction varies in the surface layer of the Ely soil as a result

of local liming practices. The Colo soil generally is neutral. It has a medium supply of available phosphorus and a very low supply of available potassium in the lower part of the surface layer. The subsoil of the Ely soil has a very low supply of available phosphorus and available potassium. Tilth is fair in the Colo soil and good in the Ely soil.

Most areas have been drained and are cultivated. Some are grassed waterways. These soils have fair potential for cultivated crops and for hay, pasture, and trees.

These soils are suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Most areas are cropped with surrounding soils because they are generally too small to be cropped separately. The soils generally are wet because of overflow and seepage from higher lying, more sloping soils. Tile drainage is needed on each side of some drainageways to remove excess water.

In drainageways where a large amount of water concentrates, a grass cover is needed to help prevent gullying. Minimum tillage helps to prevent excessive soil loss. In places contouring and terracing are beneficial. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

The use of these soils as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soils are too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIw.

41B—Sparta loamy fine sand, 1 to 5 percent slopes. This nearly level and gently sloping, excessively drained soil is on stream benches and uplands and in a few dunelike areas. Individual areas are irregular in shape and range from 2 to 30 acres in size.

Typically, the surface layer is very dark grayish brown and dark brown loamy fine sand about 28 inches thick. The subsoil is dark brown, loose fine sand and sand about 19 inches thick. The substratum to a depth of about 64 inches is strong brown, loose sand.

Permeability is rapid, and available water capacity is low. Surface runoff is slow. The content of organic matter is 1.0 to 1.5 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil has a very low supply of available phosphorus and available potassium.

Most areas are cultivated. Some are pasture or hayland. This soil has poor potential for cultivated crops and fair potential for hay, pasture, and trees.

This soil is poorly suited to corn, soybeans, and small grain because it is droughty and low in fertility. It is better suited to grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

If cultivated crops are grown, water erosion and soil blowing are hazards. Blowing sand sometimes damages newly seeded crops on this soil and on adjoining soils unless the surface is protected by a plant cover. Minimum tillage and winter cover crops help to prevent excessive soil loss. In places contouring is beneficial. Terracing is poorly suited because the soil is highly erodible and constructing or maintaining terraces is difficult.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition.

Capability subclass IVs.

41C—Sparta loamy fine sand, 5 to 9 percent slopes. This moderately sloping, excessively drained soil is on convex ridges and side slopes on uplands and in a few areas on stream benches. Individual areas are irregularly shaped and range from 2 to 35 acres in size.

Typically, the surface layer is very dark grayish brown and dark brown loamy fine sand about 24 inches thick. The subsoil is dark brown, loose fine sand and sand about 15 inches thick. The substratum to a depth of 60 inches or more is strong brown, loose sand. In some areas the surface layer is lighter in color and not so thick. In these areas the soil is lower in content of organic matter and less fertile. In some small areas the surface layer is sandy loam.

Permeability is rapid, and available water capacity is low. Surface runoff is medium. The content of organic matter is 0.5 to 1.0 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil has a very low supply of available phosphorus and available potassium.

Many areas are pasture. Some are used for cultivated crops. This soil has poor potential for cultivated crops and fair potential for hay, pasture, and trees.

This soil is poorly suited to corn, soybeans, and small grain because it is droughty and low in fertility. It is better suited to grasses and legumes for hay and pasture. Crop yields are low even in years of average rainfall. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

If cultivated crops are grown, water erosion and soil blowing are hazards. Blowing sand sometimes damages newly seeded crops on this soil and on adjoining soils unless the surface is protected by a plant cover. Minimum tillage and winter cover crops help to prevent excessive soil loss. In places contouring is beneficial. Ter-

racing is poorly suited because this soil is highly erodible and constructing or maintaining terraces is difficult.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition.

Capability subclass IVs.

41E—Sparta loamy fine sand, 9 to 18 percent slopes. This strongly sloping or moderately steep, excessively drained soil is on convex side slopes and narrow convex ridges in the uplands. Individual areas are irregularly shaped and range from 2 to 25 acres in size.

Typically, the surface layer is very dark grayish brown and dark brown loamy fine sand about 20 inches thick. The subsoil is dark brown, loose fine sand and sand about 13 inches thick. The substratum to a depth of 60 inches or more is strong brown, loose sand. In a few areas the surface layer is sandy loam.

Included with this soil in mapping are areas of soils that have a lighter colored, thinner surface layer and are lower in content of organic matter and less fertile.

Permeability is rapid, and available water capacity is low. Surface runoff is medium. The content of organic matter is less than 0.5 percent in the surface layer. Most of this organic matter is in the plow layer. The surface layer typically is medium acid, but reaction varies widely as a result of local liming practices. The subsoil has a very low supply of available phosphorus and available potassium.

Most areas are pasture. A few are used for cultivated crops. This soil has poor potential for cultivated crops and for hay and pasture and fair potential for trees.

This soil generally is not suited to corn and soybeans and is poorly suited to hay and pasture because it is droughty, low in fertility, and strongly sloping or moderately steep. Crop yields are low even in years of average rainfall. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

If cultivated crops are grown, water erosion and soil blowing are hazards. Blowing sand sometimes damages newly seeded crops on this soil and on adjoining soils unless the surface is protected by a plant cover. Minimum tillage and winter cover crops help to prevent excessive soil loss. In a few places contouring is beneficial. Terracing is poorly suited because this soil is highly erodible and constructing or maintaining terraces is difficult.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition. The carrying capacity of pasture is low.

Capability subclass VIIs.

63B—Chelsea loamy fine sand, 2 to 5 percent slopes. This gently sloping, excessively drained soil is on convex ridges and side slopes in the uplands and on stream benches. Individual areas are irregular in shape and range from 5 to 45 acres in size.

Typically, the surface layer is very dark gray and very dark grayish brown loamy fine sand about 5 inches thick. The subsurface layer is dark grayish brown, very dark grayish brown, dark brown, and yellowish brown, loose fine sand about 45 inches thick. Below this to a depth of 62 inches or more is yellowish brown, loose fine sand that has 1-inch bands of brown sandy loam. Some areas are nearly level. In places the surface layer is sandy loam.

Permeability is rapid, and available water capacity is very low. Surface runoff is medium. The content of organic matter is 0.5 to 1.0 percent in the surface layer. In uncultivated areas this layer is typically slightly acid to strongly acid, but in cultivated areas reaction varies widely as a result of local liming practices. The subsoil has a very low supply of available phosphorus and available potassium.

Most areas are pastured or wooded. Some are cultivated. This soil has poor potential for cultivated crops and for hay and pasture and fair potential for trees.

This soil is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture because it is droughty and low in fertility. Crop production is affected by the amount and timeliness of rain. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

Soil blowing is a hazard if cultivated crops are grown. It can result in damage to new seedlings on this soil and on adjacent soils (fig. 10). Minimum tillage and winter cover crops help to control soil blowing. Terracing is poorly suited because stability is poor and because constructing or maintaining terraces is difficult.

Figure 10.—Damage resulting from soil blowing on Chelsea loamy fine sand, 2 to 5 percent slopes.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition.

This soil is suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed.

Capability subclass IVs.

63C—Chelsea loamy fine sand, 5 to 9 percent slopes. This moderately sloping, excessively drained soil is on moundlike ridges and side slopes on uplands and in a few areas on stream benches. Individual areas are irregular in shape and range from 5 to 60 acres in size.

Typically, the surface layer is very dark gray and very dark grayish brown loamy fine sand about 5 inches thick. The subsurface layer is dark grayish brown, very dark grayish brown, dark brown, and yellowish brown, loose fine sand about 43 inches thick. Below this to a depth of 62 inches or more is yellowish brown, loose fine sand that has 1-inch bands of brown sandy loam. In some areas the surface layer is sandy loam.

Permeability is rapid, and available water capacity is very low. Surface runoff is medium. The content of organic matter is less than 0.5 percent in the surface layer. In uncultivated areas this layer is typically slightly acid to strongly acid, but in cultivated areas reaction varies widely as a result of local liming practices. The subsoil has a very low supply of available phosphorus and available potassium.

Most areas are pastured or wooded. A few are cultivated. This soil has poor potential for cultivated crops and for hay and pasture and fair potential for trees.

This soil is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture because it is droughty and low in fertility. Crop production is affected by the amount and timeliness of rain. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Soil blowing is a hazard if cultivated crops are grown. It can result in damage to new seedlings on this soil and on adjacent soils. Minimum tillage and winter cover crops help to prevent excessive soil loss. In most places contouring is beneficial. Terracing is poorly suited because stability is poor and constructing or maintaining terraces is difficult.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition.

This soil is suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed.

Capability subclass IVs.

63E—Chelsea loamy fine sand, 9 to 20 percent slopes. This strongly sloping to steep, excessively drained soil is on convex ridges and side slopes in the uplands. Individual areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is very dark gray and very dark grayish brown loamy fine sand about 3 inches thick. The subsurface layer is dark grayish brown, very dark grayish brown, dark brown, and yellowish brown, loose fine sand about 37 inches thick. Below this to a depth of 60 inches or more is yellowish brown, loose fine sand that has 1-inch bands of brown sandy loam.

Permeability is rapid, and available water capacity is very low. Surface runoff is medium. The content of organic matter is less than 0.5 percent in the surface layer. In uncultivated areas the surface layer is typically slightly acid to strongly acid, but in cultivated areas reaction varies widely as a result of local liming practices. The subsoil has a very low supply of available phosphorus and available potassium.

Most areas are wooded. A few are used for pasture or cultivated crops. This soil has poor potential for cultivated crops and for hay and pasture and fair to poor potential for trees.

This soil generally is not suited to corn, soybeans, and small grain or to grasses and legumes for hay and pasture. It is droughty, low in fertility, and strongly sloping to steep. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Erosion is a hazard if cultivated crops are grown. Minimum tillage and winter cover crops help to prevent excessive soil loss. In places contouring is beneficial. The soil is subject to soil blowing and should be protected by a plant cover at all times. Terracing is not suitable because stability is poor and constructing or maintaining terraces is difficult.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition.

This soil is suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed.

Capability subclass VIIs.

65D2—Lindley loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on convex nose slopes and side slopes. Individual areas are long or irregularly shaped and range from 5 to 10 acres in size.

Typically, the surface layer is dark grayish brown and yellowish brown loam about 4 inches thick. The subsoil is about 29 inches thick. The upper part is yellowish brown, firm loam; the next part is yellowish brown, firm clay loam that has a few gray mottles; the lower part is yellowish brown, firm clay loam that has a few light brownish gray mottles. The substratum to a depth of about 60 inches is yellowish brown and gray, firm clay loam. A few areas are moderately sloping.

Included with this soil in mapping are some severely eroded areas where the surface layer contains less organic matter. Also included are soils that formed in reddish clay, have a lower content of organic matter, and can be plowed or cultivated less easily than this Lindley soil.

Permeability is moderately slow, and available water capacity is high. Surface runoff is rapid. The content of organic matter is less than 1.0 percent in the surface layer. This layer typically is strongly acid, but reaction varies as a result of local liming practices. The supply of available phosphorus is medium in the subsoil and the supply of available potassium very low. Tilth generally is poor. In cultivated areas the soil tends to puddle and crust after heavy rains.

Many areas formerly were cultivated but are now used for permanent pasture or hay. This soil has poor potential for cultivated crops, fair potential for hay and pasture, and good potential for trees.

This soil is only moderately suited to corn, soybeans, and small grain. It is better suited to trees and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. Minimum tillage helps to prevent excessive soil loss. Grassed waterways can prevent gully erosion. In places contouring is beneficial. Terracing is only moderately satisfactory because the soil is strongly sloping, has a firm subsoil, and is moderately slowly permeable. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. A few areas are reverting to timberland. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed.

Capability subclass IVe.

65E2—Lindley loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, moderately well drained soil generally occurs as a narrow band around side slopes. Individual areas are long or irregularly shaped and range from 5 to 10 acres in size.

Typically, the surface layer is dark grayish brown and yellowish brown loam about 4 inches thick. The subsoil is about 27 inches thick. The upper part is yellowish brown, firm loam; the next part is yellowish brown, firm clay loam that has a few gray mottles; the lower part is yellowish brown, firm clay loam that has a few light brownish gray mottles. The substratum to a depth of about 60 inches is yellowish brown and gray, firm clay loam. In a few areas that are only slightly eroded, the surface layer contains more organic matter. In some small severely eroded areas, it contains less organic matter.

Included with this soil in mapping are soils that formed in reddish clay, have a lower content of organic matter, and can be plowed or cultivated less easily.

Permeability is moderately slow, and available water capacity is high. Surface runoff is rapid. The content of organic matter is less than 1.0 percent in the surface layer. This layer typically is strongly acid, but reaction varies as a result of local liming practices. The supply of available phosphorus is medium in the subsoil and the supply of available potassium very low. Tilth is poor. In cultivated areas the soil tends to puddle and crust after heavy rains.

Many areas formerly were cultivated but are now used for permanent pasture or hay. This soil has poor potential for cultivated crops, fair potential for hay and pasture, and fair to good potential for trees.

This soil generally is not suited to corn, soybeans, and small grain because it is too steep for the use of ordinary farm machinery. It is suited to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a severe hazard. Minimum tillage helps to prevent excessive soil loss. Terraces are not suitable because the soil is too steep, has a firm subsoil, and is moderately slowly permeable. Also, revegetating is difficult if the subsoil is exposed. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed.

Capability subclass VIe.

65F2—Lindley loam, 18 to 25 percent slopes, moderately eroded. This steep, moderately well drained soil generally occurs as narrow bands around side slopes dissected by gullies and drainageways. Individual areas are long or irregularly shaped and range from 5 to 15 acres in size.

Typically, the surface layer is dark grayish brown loam about 4 inches thick. The subsoil is about 32 inches thick. The upper part is yellowish brown, firm loam; the next part is yellowish brown, firm clay loam that has a few gray mottles; the lower part is yellowish brown, firm clay loam that has a few light brownish gray mottles. The substratum to a depth of about 60 inches is yellowish brown, firm clay loam mottled with gray. In a few areas that are only slightly eroded, the surface layer contains more organic matter. In some small severely eroded areas, it contains less organic matter. Other small areas are steeper than this Lindley soil.

Permeability is moderately slow, and available water capacity is high. Surface runoff is very rapid. The content of organic matter is less than 1.0 percent in the surface layer. This layer typically is strongly acid. The supply of available phosphorus is medium in the subsoil and the supply of available potassium very low. Tilth is poor.

Most areas are used for permanent pasture or are wooded. This soil has poor potential for cultivated crops and for hay and pasture and fair potential for trees.

This soil generally is not suited to corn, soybeans, and small grain or to grasses and legumes for hay. It is better suited to permanent pasture and trees. If cultivated crops are grown, erosion is a severe hazard. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Renovating pasture is difficult because the soil is steep. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is only moderately suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed.

Capability subclass VIIe.

83B—Kenyon loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on convex ridges and side slopes. Individual areas are irregular in shape and range from 5 to 50 acres in size.

Typically, the surface layer is very dark brown and very dark grayish brown loam about 18 inches thick. The subsoil is firm loam about 42 inches thick. The upper part is dark brown; the next part is dark yellowish brown; the lower part is yellowish brown and has grayish brown mottles that increase in number with increasing depth. The substratum to a depth of about 70 inches is yellowish brown and grayish brown, firm, calcareous loam.

Included with this soil in mapping are a few small areas where the surface layer is sandy. These areas are more droughty than this Kenyon soil.

This soil is moderately permeable. It is more rapidly permeable in the upper part of the subsoil than in the lower part or the substratum. Available water capacity is high. Surface runoff is medium. The content of organic matter is 3.0 to 4.0 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction varies in the surface layer as a result of local liming practices. The subsoil has a very low supply of available phosphorus and available potassium. Tilth is good.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard, however, if cultivated crops are grown. Minimum tillage helps to prevent excessive soil loss. In most places contouring and terracing are beneficial.

Water tends to accumulate at a depth of about 18 inches because of the difference in permeability between the loamy overburden and the underlying glacial till. A temporary water table results, especially in spring. Because providing adequate erosion control and drainage is difficult, a combination of terraces and tile drainage is needed in places. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIe.

83C—Kenyon loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on short, convex side slopes. Individual areas are irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is very dark brown and very dark grayish brown loam about 18 inches thick. The subsoil is firm loam about 42 inches thick. The upper part is dark brown; the next part is dark yellowish brown; the lower part is yellowish brown and has grayish brown mottles that increase in number with increasing depth. The substratum to a depth of about 70 inches is yellowish brown, firm, calcareous loam mottled with grayish brown.

Included with this soil in mapping are a few areas where the surface layer is sandy. These areas are more droughty than this Kenyon soil.

This soil is moderately permeable. It is more rapidly permeable in the upper part of the subsoil than in the lower part or the substratum. Available water capacity is high. Surface runoff is medium. The content of organic matter is 3.0 to 3.5 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction varies in the surface layer as a result of local liming practices. The subsoil has a very low supply of available phosphorus and available potassium. Tilth is good.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard, however, if cultivated crops are grown. Minimum tillage helps to prevent excessive soil loss. In most places contouring and terracing are beneficial.

Water tends to accumulate at a depth of about 18 inches because of the difference in permeability between the loamy overburden and the underlying glacial till. A temporary high water table results, especially in spring. Because providing adequate erosion control and drainage is difficult, a combination of terraces and tile drainage is needed in places. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIIe.

83C2—Kenyon loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on short, convex side slopes. Individual areas are irregular in shape and range from 3 to 15 acres in size.

Typically, the surface layer is very dark brown and very dark grayish brown loam about 8 inches thick. It is mixed with some of the dark brown part of the subsoil. The subsoil is firm loam about 39 inches thick. The upper part is dark brown; the next part is dark yellowish brown; the lower part is yellowish brown and has grayish brown mottles that increase in number with increasing depth. The substratum to a depth of 60 inches or more is yellowish brown and grayish brown, firm, calcareous loam.

Included with this soil in mapping are a few areas where the surface layer is sandy. These areas are droughty.

This soil is moderately permeable. It is more rapidly permeable in the upper part of the subsoil than in the lower part or the substratum. Available water capacity is high. Surface runoff is medium. The content of organic matter is 2.0 to 2.5 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction varies in the surface layer as a result of local liming practices. The subsoil has a very low supply of available phosphorus and available potassium. Tilth is fair.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Further erosion is a hazard, however, if cultivated crops are grown. Minimum tillage helps to prevent excessive soil loss. In most places contouring and terracing are beneficial. In wet years fieldwork is delayed slightly. Because providing adequate erosion control and drainage is difficult, a combination of terraces and tile drainage is needed in some areas. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIIe.

88—Nevin silty clay loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on benches along the major streams and their tributaries. Individual areas are irregular in shape and range from 5 to 25 acres in size.

Typically, the surface layer is black silty clay loam about 16 inches thick. The subsoil is friable or firm silty clay loam about 42 inches thick. The upper part is dark grayish brown, and the lower part is dark grayish brown, grayish brown, and light brownish gray and is mottled with yellowish brown or strong brown. The substratum to a depth of about 68 inches is light brownish gray silty clay loam mottled with strong brown.

Permeability is moderate, and available water capacity is high. Surface runoff is slow. The content of organic matter is 5.0 to 6.0 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The supply of available phosphorus is medium in the subsoil and the supply of available potassium high. Tilth is good.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Constructing diversion terraces on adjacent upland slopes protects this soil from runoff and siltation. The soil has a seasonal high water table. Tile drainage can improve the timeliness of fieldwork. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability class I.

110C—Lamont fine sandy loam, 2 to 9 percent slopes. This gently sloping to moderately sloping, well drained soil is on ridges and side slopes in the uplands and on stream benches. Individual areas are irregular in shape and range from 5 to 15 acres in size.

Typically, the surface layer is dark grayish brown fine sandy loam about 6 inches thick. The subsurface layer is dark grayish brown sandy loam about 3 inches thick. The subsoil is about 28 inches thick. The upper part is dark brown, friable loam; the next part is brown, friable sandy loam; the lower part is strong brown, very friable sandy loam and loamy sand. The substratum to a depth of about 65 inches is light yellowish brown, loose fine sand or sand that has thin bands of brown loamy sand. In some small areas the surface layer is lower in content of organic matter and in fertility.

This soil is moderately rapidly permeable in the upper part and very rapidly permeable in the lower part. Available water capacity is low to moderate. Surface runoff is medium. The content of organic matter is less than 0.5 to 1.0 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction varies in the surface layer as a result of local liming practices. The supply of available phosphorus is medium in the subsoil and the supply of available potassium very low. Tilth is fair.

Many areas are cultivated. A few are pastured or wooded. This soil has poor potential for cultivated crops and for hay and pasture and fair potential for trees.

This soil is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture because it is droughty. Crop production is affected by the amount and timeliness of rain. If cultivated crops are grown, water erosion and soil blowing are hazards. Minimum tillage and winter cover crops help to prevent excessive soil loss. In places contouring is beneficial. Constructing or maintaining terraces is difficult because of poor stability. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition.

This soil is well suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed.

Capability subclass IIIe.

110E—Lamont fine sandy loam, 9 to 18 percent slopes. This strongly sloping to moderately steep, well drained soil is on convex ridges and side slopes in the uplands and on stream benches. Individual areas are irregular in shape and range from 5 to 15 acres in size.

Typically, the surface layer is very dark gray fine sandy loam about 5 inches thick. The subsurface layer is dark grayish brown sandy loam about 6 inches thick. The subsoil is about 26 inches thick. The upper part is dark brown, friable loam; the next part is brown, friable sandy loam; the lower part is strong brown, very friable sandy loam and loamy sand. The substratum to a depth of 60 inches or more is light yellowish brown fine sand or sand that has thin bands of brown loamy sand. In some small areas the surface layer is lower in content of organic matter and in fertility.

This soil is moderately rapidly permeable in the upper part and very rapidly permeable in the lower part. Available water capacity is low to moderate. Surface runoff is medium. The content of organic matter is less than 0.5 percent in the surface layer. Most of this organic matter is in the plow layer. In cultivated areas reaction varies in the surface layer as a result of local liming practices. In other areas the surface layer is medium acid. The supply of available phosphorus is medium in the subsoil and the supply of available potassium very low. Tilth is fair.

Most areas are pastured or wooded. A few are cultivated. This soil has poor potential for cultivated crops and for hay and pasture and fair potential for trees.

This soil is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture because it is droughty. Crop production is affected by the amount and timeliness of rain. If cultivated crops are grown, water erosion and soil blowing are hazards. Minimum tillage and winter cover crops help to prevent excessive soil loss. In places contouring is beneficial. Constructing or maintaining terraces is difficult because of poor stability. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition.

This soil is suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed.

Capability subclass VIe.

118—Garwin silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on broad flats and at the head of drainageways. Individual areas are irregular in shape and range from 5 to several hundred acres in size.

Typically, the surface layer is black silty clay loam about 14 inches thick. The subsoil is silty clay loam about 25 inches thick. The upper part is dark gray and has dark grayish brown and light olive brown mottles, the next part is dark grayish brown and has yellowish brown mottles, and the lower part is grayish brown and has yellowish brown mottles. The substratum to a depth of about 60 inches is grayish brown silt loam mottled with yellowish brown.

Permeability is moderately slow, and available water capacity is high. Surface runoff is slow, and water ponds for short periods in some low areas. The content of organic matter is 5.5 to 6.5 percent in the surface layer. Most of this organic matter is in the plow layer. The surface layer typically is neutral. The subsoil has a very low supply of available phosphorus and available potassium. Tilth is fair unless the soil is worked when too wet.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay and pasture.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. In some areas artificial drainage is needed to lower the water table and improve the timeliness of fieldwork. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth. Gènerally, no applications of lime are needed.

Inadequately drained areas generally are pasture or hayland. Ponding can be a problem (fig. 11). If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIw.

Figure 11.—Local ponding in an undrained area of Garwin soils.

119—Muscatine silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on broad upland divides. Individual areas are irregular in shape and range from 5 to 75 acres in size.

Typically, the surface layer is about 8 inches of black silt loam over 10 inches of black and very dark brown silty clay loam. The subsoil is friable silty clay loam about 30 inches thick. The upper part is very dark grayish brown, the next part is dark grayish brown and has yellowish brown mottles, and the lower part is mottled dark grayish brown and yellowish brown or mottled grayish brown and strong brown. The substratum to a depth of about 60 inches is light brownish gray, friable silt loam mottled with yellowish brown and strong brown. In places both the upper and lower parts of the surface layer are silty clay loam.

Included with this soil in mapping are small areas of the poorly drained Garwin soils in slight depressions or in drainageways.

Permeability is moderate in the Muscatine soil, and available water capacity is high. Surface runoff is slow. The content of organic matter is 5.0 to 6.0 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. Tilth is good.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay and pasture.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It has a seasonal high water table, especially in spring. Tile drainage can improve the timeliness of fieldwork in years when the rainfall is above normal. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability class I.

119B—Muscatine silt loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is at the head of upland drainageways, at the base of side slopes, and on slight knobs. Individual areas are irregular in shape and range from 5 to 25 acres in size.

Typically, the surface layer is about 8 inches of black silt loam over 10 inches of black and very dark brown silty clay loam. The subsoil is friable silty clay loam about 30 inches thick. The upper part is very dark grayish brown, the next part is dark grayish brown and has yellowish brown mottles, and the lower part is dark grayish brown or grayish brown and has yellowish brown and strong brown mottles. The substratum to a depth of about 60 inches is light brownish gray, friable silt loam

mottled with yellowish brown and strong brown. In places both the upper and the lower parts of the surface layer are silty clay loam.

Permeability is moderate, and available water capacity is high. Surface runoff is medium in cultivated areas. The content of organic matter is 5.0 to 5.5 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction varies in the surface layer as a result of local liming practices. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. Tilth is good.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard, however, if cultivated crops are grown. Minimum tillage helps to prevent excessive soil loss. In most places contouring and terracing are beneficial.

This soil has a seasonal high water table. Tile drains some areas at the head of waterways. As a result, the timeliness of fieldwork is improved in wet years. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIe.

120—Tama silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is dominantly in the northwestern part of the county, in areas where limestone bedrock is at a depth of 6 to 7 feet. Individual areas are irregular in shape and range from 5 to 40 acres in size.

Typically, the surface layer is about 8 inches of very dark brown silt loam over 9 inches of very dark brown silty clay loam. The subsoil is friable silty clay loam about 34 inches thick. The upper part is dark brown, the next part is dark yellowish brown and yellowish brown, and the lower part is yellowish brown. The substratum is yellowish brown, friable silt loam mottled with light gray and strong brown. Limestone is 6 to 7 feet below the surface.

Permeability is moderate, and available water capacity is high. Surface runoff is slow. The content of organic matter is 4.0 to 4.5 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The supply of available phosphorus is medium in the subsoil and the supply of available potassium very low. Tilth is good.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used as pastureland or hayland, overgrazing or grazing when the soil is too wet results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability class I.

120B—Tama silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on ridges or side slopes. Individual areas are irregular in shape and range from 5 to several hundred acres in size.

Typically, the surface layer is about 6 inches of very dark brown silt loam over 7 inches of very dark brown silty clay loam. The subsoil is friable silty clay loam about 32 inches thick. The upper part is dark brown, the next part is dark yellowish brown and yellowish brown, and the lower part is yellowish brown. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam mottled with light gray and strong brown.

Permeability is moderate, and available water capacity is high. Surface runoff is medium. The content of organic matter is 3.0 to 4.0 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The subsoil has a low supply of available phosphorus and available potassium. Tilth is good.

Most areas are cultivated. Some are permanent pasture or hayland. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard, however, if cultivated crops are grown. Minimum tillage helps to prevent excessive soil loss. Most areas are well suited to contouring and terracing because slopes are long and uniform. Row crops can be grown without excessive soil losses more often in terraced areas than in areas where other conservation measures are applied. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIe.

120C—Tama silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on convex side

slopes. Individual areas are long or irregularly shaped and range from 5 to 60 acres in size.

Typically, the surface layer is very dark brown silt loam or silty clay loam about 13 inches thick. The subsoil is friable silty clay loam about 30 inches thick. The upper part is dark brown, the next part is dark yellowish brown and yellowish brown, and the lower part is yellowish brown. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam mottled with light gray and strong brown.

Permeability is moderate, and available water capacity is high. Surface runoff is medium. The content of organic matter is 3.0 to 3.5 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction varies in the surface layer as a result of local liming practices. The subsoil has a low supply of available phosphorus and available potassium. Tilth is good.

Most areas are cultivated. Some are permanent pasture or hayland. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard, however, if cultivated crops are grown. Minimum tillage helps to prevent excessive soil losses. Most areas are well suited to contouring and terracing because slopes are long and uniform. Terraced areas can be planted to row crops without excessive soil losses more often than areas where other conservation measures are applied. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIIe.

120C2—Tama silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on convex side slopes. Individual areas are long or irregularly shaped and range from 5 to several hundred acres in size.

Typically, the surface layer is about 8 inches of very dark brown silt loam mixed with some of the dark brown silty clay loam from the upper part of the subsoil. The subsoil is friable silty clay loam about 28 inches thick. The upper part is dark brown, the next part is dark yellowish brown and yellowish brown, and the lower part is yellowish brown. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam mottled with light gray and strong brown.

Permeability is moderate, and available water capacity is high. Surface runoff is medium. The content of organic matter is 2.0 to 3.5 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The subsoil has a low supply of available phosphorus and available potassium. Tilth is fair. The plow layer can puddle during intense rains. The puddling increases the runoff rate and retards plant growth.

Most areas are cultivated. A few are pasture or hayland. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Further erosion is a hazard, however, in cultivated areas. Minimum tillage helps to prevent excessive soil loss. Most areas are well suited to contouring and terracing because slopes are long and uniform. Terraced areas can be planted to row crops without excessive soil loss more often than areas where other conservation measures are applied. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIIe.

120D2—Tama silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on convex side slopes. Individual areas are long or irregularly shaped and range from 5 to 30 acres in size.

Typically, the surface layer is about 8 inches of very dark brown silt loam mixed with some of the dark brown silty clay loam from the upper part of the subsoil. The subsoil is friable silty clay loam about 26 inches thick. The upper part is dark brown, the next part is dark yellowish brown and yellowish brown, and the lower part is yellowish brown. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam mottled with light gray and strong brown. In some small areas the surface layer is thicker and darker and has a higher organic-matter content.

Permeability is moderate, and available water capacity is high. Surface runoff is medium to rapid. The content of organic matter is 1.5 to 2.0 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The subsoil has a low supply of available phosphorus and available potassium. Tilth is fair. The plow layer can puddle during intense rains. The puddling increases the runoff rate and retards plant growth.

Most areas are cultivated. A few are pasture or hayland. This soil has fair potential for cultivated crops and good potential for hay and pasture.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Further erosion is a hazard, however, in cultivated areas. Minimum tillage helps to prevent excessive soil loss. Most

areas are well suited to contouring and terracing because slopes are long and uniform. Terraced areas can be planted to row crops without excessive soil loss more often than areas where other conservation measures are applied. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIIe.

121—Tama Variant silt loam, 1 to 3 percent slopes. This nearly level to gently sloping, moderately well drained soil is dominantly in the southeastern part of the county, on gentle swells on a generally flat landscape. Individual areas are irregular in shape and range from 2 to 25 acres in size.

Typically, the surface layer is very dark brown and dark brown silt loam about 15 inches thick. The subsoil is about 32 inches thick. The upper part is yellowish brown, friable silty clay loam that has a few light gray silt coatings; the next part is grayish brown silty clay loam that has yellowish red and strong brown mottles and light gray silt coatings; the lower part is mottled grayish brown and strong brown silt loam that has light gray silt coatings. The substratum to a depth of about 60 inches is mottled light brownish gray and yellowish brown silt loam that has a few light gray silt coatings.

Permeability is moderate, and available water capacity is high. Surface runoff is slow to medium. The content of organic matter is 3.0 to 4.0 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The supply of available phosphorus is medium in the subsoil and the supply of available potassium low. Tilth is good.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Tile drainage is needed in some areas. Fieldwork can be done earlier if tile drainage is provided. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability class I.

122—Sperry silt loam, 0 to 1 percent slopes. This nearly level, very poorly drained or poorly drained soil is in broad divides. It is subject to ponding by runoff from adjacent areas. Individual areas generally are circular and range from 1 acre to 5 acres in size.

Typically, the surface layer is black silt loam about 9 inches thick. The subsurface layer is dark gray and very dark gray, friable silt loam about 9 inches thick. The subsoil is about 42 inches thick. The upper part is very dark gray, firm silty clay mottled with yellowish brown and light olive brown; the next part is gray, firm silty clay loam mottled with yellowish brown and light olive brown; the lower part is olive gray, firm silty clay loam mottled with strong brown. The substratum to a depth of about 66 inches is olive gray, friable silt loam mottled with strong brown.

Permeability is slow or very slow, and available water capacity is high. Surface runoff is very slow to ponded. The content of organic matter is 4.0 to 6.0 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The subsoil has a very low supply of available phosphorus and available potassium. Tilth is good.

Most drained areas are cultivated. Most undrained areas are left in permanent pasture. Small isolated areas are left idle in wet years or are used for wildlife habitat. This soil has fair potential for cultivated crops and for hay and pasture. Undrained areas have good potential as habitat for wetland wildlife.

This soil is suited to corn and soybeans if it is drained. Surface drains are needed in areas where tile does not drain the soil satisfactorily. Because the areas of this soil are small, the cropping system is generally determined by the way adjacent soils are used. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIIw.

133—Colo silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on flood plains and in narrow upland drainageways. It is subject to flooding. Individual areas are long or irregularly shaped and range from 20 to several hundred acres in size.

Typically, the surface layer is black and very dark gray silty clay loam about 43 inches thick. The substratum to a depth of about 60 inches is olive gray, firm silty clay loam mottled with olive brown.

Permeability is moderate, and available water capacity is high. Surface runoff is very slow to ponded. The content of organic matter is 5.0 to 7.0 percent in the surface layer. Reaction typically is neutral or slightly acid in the

upper part of the surface layer and neutral in the lower part and in the substratum. The supply of available phosphorus is medium in the lower part of the surface layer and the supply of available potassium very low. Tilth is fair. The soil puddles readily when wet and is cloddy and hard when dry.

Most areas are cultivated. Some are permanent pasture. This soil has good potential for cultivated crops and for hay and pasture if it is drained and protected from floodwater.

This soil is suited to corn and soybeans and to grasses and legumes for hay and pasture if artificial drainage is provided and the frequency of flooding is limited. In some years spring plowing and planting are delayed because of flooding. In some areas artificial drainage is needed to lower the water table and improve the timeliness of fieldwork. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth. Generally, no applications of lime are needed.

Areas that are frequently flooded, cut up by old stream channels, or inadequately drained are generally pasture or hayland. If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIw.

133+—Colo silt loam, overwash, 0 to 2 percent slopes. This nearly level, poorly drained soil is on flood plains and in narrow upland drainageways. It is subject to flooding. Individual areas are long or irregularly shaped and range from 20 to 100 acres in size.

Typically, the surface layer is about 10 inches of dark gray, dark grayish brown, or grayish brown silt loam over 33 inches of black to very dark gray silty clay loam. The substratum to a depth of 60 inches is olive gray, firm silty clay loam mottled with olive brown.

Permeability is moderate, and available water capacity is high. Surface runoff is very slow to ponded. The content of organic matter is 4.0 to 5.0 percent in the surface layer. The surface layer and substratum typically are neutral. The supply of available phosphorus is medium in the lower part of the surface layer and the supply of available potassium very low. Tilth is fair.

Most areas are cultivated. Some are permanent pasture. This soil has good potential for cultivated crops and for hay and pasture if it is drained and protected against flooding and siltation.

This soil is suited to corn and soybeans and to grasses and legumes for hay and pasture if artificial drainage is provided and the frequency of flooding is limited. The flooding delays spring plowing and planting in some years. This soil is generally not so wet as Colo silty clay loam, which has no overwash, but it can benefit from artificial drainage. Because the surface layer is silt loam, preparing the seedbed and plowing are easier on this soil than on other Colo soils. Constructing diversion terraces on soils upslope can protect this soil from siltation and runoff. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIw.

143—Brady sandy loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on stream benches and in upland drainageways. Individual areas are irregular in shape and range from 5 to 40 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 9 inches thick. The subsurface layer is about 4 inches of dark grayish brown sandy loam that has a few yellowish brown mottles. The subsoil is about 25 inches thick. The upper part is grayish brown, friable loam mottled with yellowish brown; the next part is mottled yellowish brown and grayish brown, friable sandy loam; the lower part is mottled grayish brown and strong brown, very friable sandy loam. The substratum to a depth of about 60 inches is pale brown, loose fine sand and sand mottled with dark brown.

Included with this soil in mapping are a few areas where the surface layer is silt loam and some areas where sand and gravel are at a depth of more than 40 inches.

This soil is moderately rapidly permeable in the upper part and very rapidly permeable in the lower part. Available water capacity is low to moderate. Surface runoff is slow. The content of organic matter is 2.0 to 3.0 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. Tilth is fair.

Many areas have been drained and are cultivated. This soil has fair potential for cultivated crops and for hay, pasture, and trees.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. In cultivated areas, however, erosion is a hazard if the surface is unprotected after fall plowing. Minimum tillage and winter cover crops help to prevent excessive soil loss. Droughtiness is a hazard during some periods of below normal rainfall. The water table fluctuates between depths of 1 foot and 3 feet in spring but drops rapidly during the growing season. Some areas can benefit from artificial drainage during wet periods, but installing tile is difficult because of the loose, water bearing sand. Re-

turning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed.

Capability subclass IIs.

160—Walford silt loam, 0 to 1 percent slopes. This nearly level, poorly drained soil is in flat or depressed areas. Individual areas are irregular in shape and range from 2 to 35 acres in size.

Typically, the surface layer is very dark gray silt loam about 6 inches thick. The subsurface layer is dark grayish brown and grayish brown silt loam about 9 inches thick. The subsoil is about 45 inches thick. It is, in sequence downward, grayish brown, friable silt loam mottled with strong brown; light brownish gray, firm silty clay loam that has strong brown mottles and light gray silt coatings; grayish brown, firm silty clay loam mottled with strong brown; and mottled grayish brown or light brownish gray and strong brown, firm silty clay loam. The substratum to a depth of about 65 inches is mottled light brownish gray and yellowish brown, friable silt loam. In some small areas the surface layer is thinner and is dark colored.

Included with this soil in mapping are areas that have 8 to 20 inches of light colored overwash.

Permeability is slow, and available water capacity is high. Surface runoff is slow to ponded. The content of organic matter is 2.5 to 3.5 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The subsoil has a very low supply of available phosphorus and available potassium. Tilth is fair. The soil puddles after heavy rains or if it is worked when wet.

Many areas are cultivated. A few are permanent pasture. Undrained areas are generally left idle. A few small isolated areas are left idle in wet years or are used as wildlife habitat. This soil has fair potential for cultivated crops and for hay and pasture.

If drained, this soil is suited to corn and soybeans. It is also suited to grasses and legumes for hay and pasture. Some areas are ponded for short periods; the ponding drowns out crops in some years. Drainage by both open ditches and tile is needed in some areas. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIw.

162B—Downs silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on narrow ridges and broad divides. Individual areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 3 inches thick. The subsoil is about 38 inches thick. The upper part is dark brown, friable silt loam; the next part is dark yellowish brown and yellowish brown, friable silty clay loam; the lower part is mottled light brownish gray and yellowish brown, friable silty clay loam. The substratum to a depth of about 71 inches is mottled light brownish gray and yellowish brown, friable silt loam.

Permeability is moderate, and available water capacity is high. Surface runoff is medium. The content of organic matter is 2.0 to 3.0 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The supply of available phosphorus is medium in the subsoil and the supply of available potassium very low. Tilth is good. The soil tends to crust, however, after heavy rains.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard, however, in cultivated areas. Minimum tillage helps to prevent excessive soil loss. Some areas are well suited to contouring and terracing because slopes are long and uniform. Terraced areas can be planted to row crops without excessive soil losses more often than areas where other conservation measures are applied. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation or by spraying, cutting, and girdling.

Capability subclass IIe.

162C—Downs silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on narrow ridgetops and long, convex side slopes. Individual areas are

long or irregularly shaped and range from 5 to 50 acres in size.

Typically, the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 3 inches thick. The subsoil is about 37 inches thick. The upper part is dark brown, friable silt loam; the next part is dark yellowish brown and yellowish brown, friable silty clay loam; the lower part is mottled light brownish gray and yellowish brown, friable silty clay loam. The substratum to a depth of 60 inches or more is mottled light brownish gray and yellowish brown, friable silt loam.

Permeability is moderate, and available water capacity is high. Surface runoff is medium. The content of organic matter is 2.0 to 2.5 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The supply of available phosphorus is medium in the subsoil and the supply of available potassium very low. Tilth is good. The soil tends to crust, however, after heavy rains.

Most areas support grass or trees. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard, however, in cultivated areas. Minimum tillage helps to prevent excessive soil loss. Some areas are well suited to contouring and terracing because the slopes are long and uniform. Terraced areas can be planted to row crops without excessive soil loss more often than areas where other conservation measures are applied. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation or by spraying, cutting, and girdling.

Capability subclass IIe.

162C2—Downs silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on narrow ridgetops and convex side slopes. Individual areas are long or irregularly shaped and range from 10 to several hundred acres in size.

Typically, the surface layer is about 8 inches of very dark grayish brown silt loam mixed with some of the dark brown silt loam from the upper part of the subsoil. The subsoil is about 35 inches thick. The upper part is dark brown, friable silt loam; the next part is dark yellowish brown and yellowish brown, friable silty clay loam; the lower part is mottled light brownish gray and yellowish brown, friable silty clay loam. The substratum to a depth of 60 inches or more is mottled light brownish gray and yellowish brown, friable silt loam.

Permeability is moderate, and available water capacity is high. Surface runoff is medium. The content of organic matter is 1.5 to 2.0 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The supply of available phosphorus is medium in the subsoil and the supply of available potassium very low. Tilth is fair. The soil tends to crust after heavy rains.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Further erosion is a hazard, however, in cultivated areas. Minimum tillage helps to prevent excessive soil loss. Some areas are well suited to contouring and terracing because slopes are long and uniform. Terraced areas can be planted to row crops without excessive soil loss more often than areas where other conservation measures are applied. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation or by spraying, cutting, and girdling.

Capability subclass IIIe.

162D2—Downs silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on convex side slopes. Individual areas are long or irregularly shaped and range from 10 to several hundred acres in size.

Typically, the surface layer is about 8 inches of very dark grayish brown silt loam mixed with some of the dark brown silt loam from the upper part of the subsoil. The subsoil is about 33 inches thick. The upper part is dark brown, friable silt loam; the next part is dark yellowish brown and yellowish brown, friable silty clay loam; the lower part is mottled light brownish gray and yellowish brown, friable silty clay loam. The substratum to a depth of 60 inches or more is mottled light brownish gray and yellowish brown, friable silt loam. In some small areas,

the surface layer is thicker and darker and the content of organic matter and fertility are higher.

Permeability is moderate, and available water capacity is high. Surface runoff is medium to rapid. The content of organic matter is 1.0 to 2.5 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The supply of available phosphorus is medium in the subsoil and the supply of available potassium very low. Tilth is fair. The soil tends to crust after heavy rains.

Most areas are cultivated. This soil has fair potential for cultivated crops and good potential for hay, pasture, and trees.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Further erosion is a hazard, however, in cultivated areas. Minimum tillage helps to prevent excessive soil loss. Some areas are well suited to contouring and terracing. Terraced areas can be planted to row crops without excessive soil loss more often than areas where other conservation measures are applied. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation or by spraying, cutting, and girdling.

Capability subclass IIIe.

163B—Fayette silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on convex, moderately wide ridgetops. Individual areas are irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 5 inches thick. The subsurface layer is dark grayish brown and dark brown, friable silt loam about 6 inches thick. The subsoil is friable silty clay loam about 47 inches thick. The upper part is dark brown, the next part is yellowish brown, and the lower part is dark yellowish brown and yellowish brown and has a few light brownish gray mottles. The substratum to a depth of about 68 inches is yellowish brown, friable silt loam that has a few light brownish gray mottles. Some small areas are nearly level.

Permeability is moderate, and available water capacity is high. Surface runoff is medium. The content of organic matter is 1.5 to 2.5 percent in the surface layer. Reaction varies widely in this layer as a result of local liming practices. The supply of available phosphorus is high in the subsoil and the supply of available potassium very low. Tilth is good. The soil tends to puddle or crust after heavy rains.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to legumes for hay and pasture. Erosion is a hazard, however, in cultivated areas. Minimum tillage helps to prevent excessive soil loss. In many areas slopes are long and smooth enough for terracing and contour farming. Terraced areas can be planted to row crops without excessive soil loss more often than areas where other conservation measures are applied. Returning crop residue to the soil or regularly adding other organic material improves fertility, reduces crusting, increases the rate of water infiltration, and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation or by spraying, cutting, or girdling.

Capability subclass IIe.

163C—Fayette silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on convex side slopes and narrow ridgetops. Individual areas are long or irregularly shaped and range from 5 to 120 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 5 inches thick. The subsurface layer is dark grayish brown and dark brown silt loam about 6 inches thick. The subsoil is friable silty clay loam about 45 inches thick. The upper part is dark brown, the next part is yellowish brown, and the lower part is dark yellowish brown and has a few light brownish gray mottles. The substratum to a depth of 60 inches or more is yellowish brown, friable silt loam that has a few light brownish gray mottles.

Permeability is moderate, and available water capacity is high. Surface runoff is medium. The content of organic matter is 1.0 to 2.0 percent in the surface layer. Reaction varies widely in this layer as a result of local liming practices. The supply of available phosphorus is high in the subsoil and the supply of available potassium very low. Tilth is good. The soil tends to puddle and crust, however, after heavy rains.

Most areas are timberland or permanent pasture. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard, however, in cultivated areas. Minimum tillage helps to prevent excessive soil loss. In most places contouring and terracing are beneficial. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation or by spraying, cutting, and girdling.

Capability subclass IIIe.

163C2—Fayette silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on convex side slopes and narrow ridgetops. Individual areas are long or irregularly shaped and range from 5 to several hundred acres in size.

Typically, the surface layer is about 6 inches of dark grayish brown and dark brown silt loam mixed with some of the silty clay loam from the upper part of the subsoil. The subsoil is friable silty clay loam about 43 inches thick. The upper part is dark brown, the next part is yellowish brown, and the lower part is dark yellowish brown and has a few light brownish gray mottles. The substratum to a depth of 60 inches or more is yellowish brown, friable silt loam that has a few light brownish gray mottles.

Permeability is moderate, and available water capacity is high. Surface runoff is medium. Reaction varies widely in the surface layer as a result of local liming practices. The supply of available phosphorus generally is high in the subsoil and the supply of available potassium very low. The content of organic matter is 0.5 to 1.0 percent in the surface layer. Tilth is fair. The soil tends to puddle and crust after heavy rains.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is suited to corn, soybeans, and small grain and to legumes for hay and pasture. Further erosion is a hazard, however, in cultivated areas. Minimum tillage helps to prevent excessive soil loss. In a few areas slopes are long and smooth enough for stripcropping and contour farming. Returning crop residue to the soil or regularly adding other organic material improves fertility, reduces crusting, and increases the rate of water infiltration.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, excessive runoff, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation or by spraying, cutting, and girdling.

Capability subclass IIIe.

163D—Fayette silt loam, 9 to 14 percent slopes. This strongly sloping, well drained soil is on convex side slopes and narrow ridgetops in the uplands. Individual areas are irregular in shape and range from 5 to 50 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 5 inches thick. The subsurface layer is dark grayish brown and dark brown silt loam about 6 inches thick. The subsoil is friable silty clay loam about 42 inches thick. The upper part is dark brown, the next part is yellowish brown, and the lower part is dark yellowish brown and yellowish brown and has a few light brownish gray mottles. The substratum to a depth of 60 inches or more is yellowish brown, friable silt loam that has a few light brownish gray mottles. In cultivated areas part or all of the original subsurface layer has been mixed into a plow layer.

Permeability is moderate, and available water capacity is high. Surface runoff is medium. The content of organic matter is 1.0 to 2.0 percent in the surface layer. Reaction varies widely in this layer as a result of local liming practices. The supply of available phosphorus is high in the subsoil and the supply of available potassium very low. Tilth is good in pastured and other uncultivated areas, but the soil tends to puddle and crust in cultivated areas after heavy rains.

Most areas remain in native hardwoods or are permanent pasture. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is suited to corn and soybeans and to grasses and legumes for hay and pasture. Erosion is a hazard, however, in cultivated areas. Minimum tillage helps to prevent excessive soil loss. In many areas slopes are long and uniform enough for terracing and contour farming. Terraced areas can be planted to row crops without excessive soil loss more often than areas where other conservation measures are applied. Returning crop residue to the soil or regularly adding other organic material improves fertility, reduces crusting, and increases the rate of water infiltration.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compac-

tion, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation or by spraying, cutting, and girdling.

Capability subclass IIIe.

163D2—Fayette silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on convex side slopes and narrow ridgetops. Individual areas are long or irregularly shaped and range from 20 to 200 acres in size.

Typically, the surface layer is about 8 inches of dark grayish brown and dark brown silt loam mixed with some of the silty clay loam from the subsoil. The subsoil is friable silty clay loam about 40 inches thick. The upper part is dark brown, the next part is yellowish brown, and the lower part is dark yellowish brown and has a few light brownish gray mottles. The substratum to a depth of 60 inches or more is yellowish brown, friable silt loam that has a few light brownish gray mottles.

Permeability is moderate, and available water capacity is high. Surface runoff is medium to rapid. The content of organic matter is 0.5 to 1.0 percent in the surface layer. Reaction varies widely in this layer as a result of local liming practices. The supply of available phosphorus is high in the subsoil and the supply of available potassium very low. Tilth is fair. The soil tends to puddle and crust after heavy rains. The puddling or crusting increases the runoff rate and retards plant growth.

Most areas are cultivated. A few are pastured. This soil has fair potential for cultivated crops and good potential for hay, pasture, and trees.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Further erosion is a hazard, however, in cultivated areas. Minimum tillage helps to prevent excessive soil loss. Grassed waterways are needed to prevent the formation of gullies in areas where water concentrates. In many areas slopes are long and uniform enough for terracing and contour farming. Terraced areas can be planted to row crops without excessive soil loss more often than areas where other conservation measures are applied. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation or by spraying, cutting, and girdling.

Capability subclass IIIe.

163D3—Fayette silty clay loam, 9 to 14 percent slopes, severely eroded. This strongly sloping, well drained soil is on convex side slopes and narrow ridgetops. Individual areas are long or irregularly shaped and range from 20 to 100 acres in size.

Typically, the surface layer is mixed dark brown and yellowish brown silty clay loam about 8 inches thick. The subsoil is friable silty clay loam about 38 inches thick. The upper part is dark brown, the next part is yellowish brown, and the lower part is dark yellowish brown and has a few light brownish gray mottles. The substratum to a depth of 60 inches or more is yellowish brown, friable silt loam that has a few light brownish gray mottles.

Permeability is moderate, and available water capacity is high. Surface runoff is rapid. The content of organic matter is less than 0.5 percent in the surface layer. Reaction varies widely in this layer as a result of local liming practices. The supply of available phosphorus is high in the subsoil and the supply of available potassium very low. Tilth is poor. The soil is cloddy after it has been worked when wet, and it can puddle during intense rains. As a result, the runoff rate is increased and plant growth retarded.

Most areas are cultivated. This soil has fair to poor potential for cultivated crops and good potential for hay, pasture, and trees.

This soil is suited to an occasional row crop in rotation with small grain and grasses and legumes for hay and pasture. It is best suited to hay and pasture. If cultivated crops are grown, further erosion is a hazard. Minimum tillage helps to prevent excessive soil loss. Some gullies and drainageways should be shaped and reseeded. In a few areas slopes are long and uniform enough for terracing and contour farming. Terraced areas can be planted to row crops without excessive soil loss more often than areas where other conservation measures are applied. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation or by spraying, cutting, and girdling.

Capability subclass IVe.

163E—Fayette silt loam, 14 to 18 percent slopes. This moderately steep, well drained soil is on long, convex side slopes. Individual areas are long or irregularly shaped and range from 10 to 50 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is dark grayish brown and dark brown, friable silt loam about 6 inches thick. The subsoil is friable silty clay loam about 40 inches thick. The upper part is dark brown, the next part is yellowish brown, and the lower part is dark yellowish brown and has a few light brownish gray mottles. The substratum to a depth of 60 inches or more is yellowish brown, friable silt loam mottled with light brownish gray. In a few areas the surface layer is thicker and darker and has a higher content of organic matter.

Permeability is moderate, and available water capacity is high. Surface runoff is rapid. The content of organic matter is about 1.0 percent in the surface layer. Reaction varies widely in this layer as a result of local liming practices. The supply of available phosphorus is high in the subsoil and the supply of available potassium very low. Tilth is good. In cultivated areas the soil tends to puddle and crust after heavy rains.

Most areas are used for permanent pasture or are wooded (fig. 12). This soil has poor potential for cultivated crops and good potential for hay, pasture, and trees.

This soil is suited to an occasional row crop in rotation with small grain and grasses and legumes for hay and pasture. It is best suited to hay and pasture. If cultivated crops are grown, erosion is a severe hazard. Minimum tillage helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed.

Figure 12.—Pasture and trees on Fayette silt loam, 14 to 18 percent slopes. The farm pond provides livestock water, recreation, and control of gullying.

Capability subclass IVe.

163E3—Fayette silty clay loam, 14 to 18 percent slopes, severely eroded. This moderately steep, well drained soil is on short, convex slopes dissected by gullies and waterways. Individual areas are long or irregularly shaped and range from 5 to 60 acres in size.

Typically, the surface layer is mixed dark brown and yellowish brown silty clay loam about 8 inches thick. The subsoil is friable silty clay loam about 36 inches thick. The upper part is dark brown, the next part is yellowish brown, and the lower part is dark yellowish brown and has a few light brownish gray mottles. The substratum to a depth of 60 inches or more is yellowish brown, friable silt loam that has a few light brownish gray mottles. In a few areas the surface layer is thicker and darker colored and has a higher content of organic matter.

Permeability is moderate, and available water capacity is high. Surface runoff is rapid. The content of organic matter is less than 0.5 percent in the surface layer. Reaction varies widely in this layer as a result of local liming practices. The supply of available phosphorus is high in the subsoil and the supply of available potassium very low. Tilth is poor. The soil is cloddy after it has been worked when wet, and it can puddle during intense rains. As a result, the runoff rate is increased and plant growth retarded.

Most areas are cultivated. This soil has poor potential for cultivated crops and fair potential for hay, pasture, and trees.

This soil is poorly suited to cultivated crops. Erosion is a very severe hazard in cultivated areas. If tillage is needed, the crop should be grown only to reestablish grasses and legumes for hay and pasture. Minimum tillage helps to prevent excessive soil loss. Also, shaping and seeding waterways and gullies can be beneficial. Diversion terraces help to protect the soils downslope against runoff and siltation. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed.

Capability subclass VIe.

163F—Fayette silt loam, 18 to 25 percent slopes. This steep, well drained soil is on short, convex side slopes. Individual areas are long or irregularly shaped and range from 5 to 150 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is friable silty clay loam about 36 inches thick. The upper part is dark brown, the next part is yellowish brown, and the lower part is dark yellowish brown and has a few light brownish gray mottles. The substratum to a depth of 60 inches or more is yellowish brown, friable silt loam that has a few light brownish gray mottles.

Included with this soil in mapping are a few areas where limestone crops out.

Permeability is moderate, and available water capacity is high. Surface runoff is rapid. The content of organic matter is less than 0.5 percent in the surface layer. This layer is typically slightly acid or medium acid. The supply of available phosphorus is high in the subsoil and the supply of available potassium very low. Tilth is good, but the soil puddles readily.

Most areas are used for permanent pasture or are wooded. This soil has poor potential for cultivated crops and fair potential for hay and pasture. It has good potential for trees.

This soil is poorly suited to corn, soybeans, and small grain and is only moderately well suited to hay. The steep slopes and the waterways hinder farm machinery. If cultivated crops are grown, erosion is a severe hazard. Minimum tillage helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed.

Capability subclass VIe.

163F2—Fayette silt loam, 18 to 25 percent slopes, moderately eroded. This steep, well drained soil is on short, convex side slopes. Individual areas are long or irregularly shaped and range from 10 to 175 acres in size.

Typically, the surface layer is about 8 inches of dark grayish brown and dark brown silt loam mixed with some of the silty clay loam from the subsoil. The subsoil is friable silty clay loam about 33 inches thick. The upper part is dark brown, the next part is yellowish brown, and the lower part is dark yellowish brown and has a few light brownish gray mottles. The substratum to a depth of 60 inches or more is yellowish brown, friable silt loam

that has a few light brownish gray mottles. In some areas the soil is severely eroded, has a lower content of organic matter, and is less fertile.

Included with this soil in mapping are a few areas where limestone crops out.

Permeability is moderate, and available water capacity is high. Surface runoff is rapid. The content of organic matter is less than 0.5 percent in the surface layer. This layer typically is slightly acid or medium acid. The supply of available phosphorus is high in the subsoil and the supply of available potassium very low. Tilth is fair. The soil can puddle and crust after heavy rains. As a result, the runoff rate is increased and plant growth retarded.

Many areas are cultivated. Some are seeded to pasture. This soil has poor potential for cultivated crops and fair potential for hay, pasture, and trees.

This soil is poorly suited to corn, soybeans, and small grain and only moderately well suited to hay. The steep slopes and the gullies and waterways hinder farm machinery. If cultivated crops are grown, further erosion is a severe hazard. If tillage is needed, the crop should be grown only to reestablish grasses for hay and pasture. Minimum tillage helps to prevent excessive soil loss. Also, shaping and seeding waterways and gullies can be beneficial. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed.

Capability subclass VIe.

163G—Fayette silt loam, 25 to 40 percent slopes. This very steep, well drained soil is on short, convex side slopes. Individual areas are long or irregularly shaped and range from 5 to 40 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is dark grayish brown and dark brown, friable silt loam about 6 inches thick. The subsoil is friable silty clay loam about 32 inches thick. The upper part is dark brown, the next part is yellowish brown, and the lower part is dark yellowish brown and has a few light brownish gray mottles. The substratum to a depth of 60 inches or more is yellowish brown, friable silt loam that has a few light brownish gray mottles. Some areas are moderately eroded or severely eroded. In these eroded areas the soil contains less organic matter and is less fertile.

Included with this soil in mapping are areas where limestone crops out.

Permeability is moderate, and available water capacity is high. Surface runoff is rapid. The content of organic matter is less than 0.5 percent in the surface layer. This layer typically is slightly acid or medium acid. The supply of available phosphorus is high in the subsoil and the supply of available potassium very low. Tilth is good, but the soil tends to puddle readily.

Most areas are used for permanent pasture or are wooded. This soil has poor potential for cultivated crops and for hay and pasture. It has fair potential for trees.

This soil is poorly suited to corn, soybeans, and small grain and to hay and permanent pasture. It is too steep for the use of ordinary farm machinery. Also, applying fertilizer and lime is difficult on this very steep soil.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is only moderately suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed.

Capability subclass VIIe.

171B—Bassett loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on slightly convex ridge crests and side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 30 acres in size.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsoil is about 38 inches thick. The upper part is yellowish brown and dark yellowish brown, friable loam, and the lower part is yellowish brown, firm loam mottled with grayish brown. The substratum to a depth of about 66 inches is yellowish brown, firm loam mottled with grayish brown.

This soil is moderately permeable. It is more rapidly permeable in the upper part of the subsoil than in the lower part or the substratum. Available water capacity is high. Surface runoff is medium. The content of organic matter is 2.0 to 3.0 percent in the surface layer. Reaction varies widely in this layer as a result of local liming practices. The subsoil has a very low supply of available phosphorus and available potassium. Tilth is good.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is suited to corn, soybeans, and small grain and to legumes for hay and pasture. Erosion is a hazard, however, in cultivated areas. Minimum tillage helps to prevent excessive soil loss. Returning crop residue to the soil or adding other organic material improves fertility, reduces crusting, and increases the rate of water infiltration.

The effects of providing erosion control conflict somewhat with the effects of providing adequate drainage.

The uniform slopes are well suited to contour cultivation and terraces. In areas that are terraced or farmed on the contour, however, surface water moves more slowly. As a result, more of the water soaks into the soil. This extra water complicates drainage, especially in wet years. A combination of terraces and tile is needed in some areas. If terraces are constructed, the extent to which glacial till is exposed should be minimal because of the low fertility of the exposed material and the characteristics that do not favor tillage.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed.

Capability subclass IIe.

171C2—Bassett loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on short, convex side slopes in the uplands. Individual areas are irregular in shape and range from 5 to 30 acres in size.

Typically, the surface layer is brown and yellowish brown loam about 8 inches thick. The subsoil is about 36 inches thick. The upper part is dark yellowish brown and yellowish brown, friable loam; the next part is yellowish brown, firm loam; the lower part is yellowish brown, firm loam that has a few grayish brown mottles. The substratum to a depth of 60 inches or more is yellowish brown and grayish brown, firm loam. In places the surface layer is darker colored and contains more organic matter.

Included with this soil in mapping are small areas of sandy or gravelly soils. These soils have a lower available water capacity than this Bassett soil and are more quickly affected by drought.

This soil is moderately permeable. It is more rapidly permeable in the upper part of the subsoil than in the lower part or the substratum. Available water capacity is high. Surface runoff is medium. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil has a very low supply of available phosphorus and available potassium. The content of organic matter is 1.5 to 2.0 percent in the surface layer. Tilth is fair.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Further erosion is a hazard, however, in cultivated areas. Minimum tillage helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

The effects of providing erosion control conflict somewhat with the effects of providing adequate drainage. The slopes are well suited to contour cultivation and terraces. Surface water moves more slowly, however, in areas that are terraced or farmed on the contour. As a result, more of the water soaks into the soil. This extra water complicates drainage, especially in wet years. A combination of terraces and tile is needed in some areas. If terraces are constructed, the extent to which glacial till is exposed should be minimal because of the low fertility of the exposed material and the characteristics that do not favor tillage.

The use of the soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, results in surface compaction, an increased runoff rate, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed.

Capability subclass IIIe.

171D2—Bassett loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on short, convex side slopes in the uplands. Individual areas are irregular in shape and range from 5 to 25 acres in size.

Typically, the surface layer is brown and yellowish brown loam about 8 inches thick. The subsoil is about 36 inches thick. The upper part is dark yellowish brown and yellowish brown, friable loam; the next part is yellowish brown, firm loam; the lower part is yellowish brown, firm loam that has a few grayish brown mottles. The substratum to a depth of 60 inches or more is yellowish brown and grayish brown, firm loam. In places the surface layer is darker colored and contains more organic matter. In some small areas the slope is more than 14 percent.

Included with this soil in mapping are small areas of Waubeek soils. These soils have a silt loam surface layer and silty clay loam in the upper part of the subsoil.

This soil is moderately permeable. It is more rapidly permeable in the upper part of the subsoil than in the lower part or the substratum. Available water capacity is high. Surface runoff is medium. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil has a very low supply of available phosphorus and available potassium. The content of organic matter is 1.0 to 1.5 percent in the surface layer. Tilth is fair.

Most areas are cultivated. This soil has fair potential for cultivated crops if erosion is controlled. It has good potential for hay, pasture, and trees.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Further erosion is a hazard, however, in cultivated areas. Minimum tillage helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

The effects of providing erosion control conflict somewhat with the effects of providing adequate drainage. The slopes are suitable for cultivating on the contour and terracing. Surface water moves slowly, however, in areas that are cultivated on the contour or terraced. As a result, more of the water soaks into the soil. This extra water complicates drainage, especially in wet years. A combination of terraces and tile is needed in some areas. If terraces are constructed, the extent to which glacial till is exposed should be minimal because of the low fertility of the exposed material and the characteristics that do not favor tillage.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, results in surface compaction, an increased runoff rate, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed.

Capability subclass IIIe.

175B—Dickinson fine sandy loam, 1 to 5 percent slopes. This nearly level to gently sloping, well drained and somewhat excessively drained soil is on ridges and side slopes in the uplands and on stream benches. Individual areas are irregular in shape and range from 3 to 40 acres in size.

Typically, the surface layer is very dark brown fine sandy loam about 7 inches thick. The subsurface layer is very dark brown, very dark grayish brown, and dark brown, very friable sandy loam about 11 inches thick. The subsoil is about 22 inches thick. The upper part is dark brown, very friable fine sandy loam, and the lower part is strong brown, very friable loamy sand. The substratum to a depth of about 60 inches is yellowish brown, loose sand.

Included with the soil in mapping are a few upland areas where glacial till is as shallow as 3 to 4 feet.

Permeability is moderately rapid, and available water capacity is moderate. Surface runoff is slow to medium. The content of organic matter is 1.0 to 2.0 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The subsoil has a very low supply of available phosphorus and available potassium. Tilth is good.

Most areas are cultivated. A few are hayland or permanent pasture. This soil has fair potential for cultivated crops and for hay, pasture, and trees.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture, but it is droughty in most years. Also, water erosion and soil blowing are hazards in cultivated areas. Blowing sand sometimes damages newly seeded crops on this soil and on adjoining soils unless the surface is protected by plant cover. Minimum tillage and winter cover crops help to prevent excessive soil loss. In most places contouring and terracing are beneficial. Constructing or maintaining terraces is difficult in some areas because of poor stability. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition. The carrying capacity of pasture is slightly reduced during periods when the soil is droughty.

Capability subclass IIIe.

175C—Dickinson fine sandy loam, 5 to 9 percent slopes. This moderately sloping, well drained to somewhat excessively drained soil is on convex ridges and side slopes on uplands and stream benches. Individual areas are irregular in shape and range from 5 to 40 acres in size.

Typically, the surface layer is very dark brown fine sandy loam about 7 inches thick. The subsurface layer is very dark grayish brown and dark brown, very friable sandy loam about 11 inches thick. The subsoil is about 19 inches thick. The upper part is dark brown, very friable sandy loam, and the lower part is strong brown, very friable loamy sand. The substratum to a depth of about 60 inches is yellowish brown, loose sand.

Included with this soil in mapping are a few upland areas where glacial till is as shallow as 3 to 4 feet.

Permeability is moderately rapid, and available water capacity is moderate. Surface runoff is medium. The content of organic matter is 1.0 to 1.5 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The subsoil has a very low supply of available phosphorus and available potassium. Tilth is good.

Most areas are cultivated. Some areas are hayland or permanent pasture. This soil has fair potential for cultivated crops and for hay, pasture, and trees.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture, but it is droughty. Yields are low unless rainfall is timely.

If cultivated crops are grown, water erosion and soil blowing are hazards. Blowing sand sometimes damages

newly seeded crops on this soil and on adjoining soils unless the surface is protected by plant cover. Minimum tillage and winter cover crops help to prevent excessive soil loss. In most places contouring and terracing are beneficial. Constructing or maintaining terraces is difficult in some areas because of poor stability. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition. The carrying capacity of pasture is slightly reduced during periods when the soil is droughty.

Capability subclass IIIe.

177—Saude loam, 1 to 3 percent slopes. This nearly level to gently sloping, well drained soil is on stream benches and on uplands. Individual areas are irregular in shape and range from 2 to 50 acres in size.

Typically, the surface layer is very dark brown and dark brown loam about 17 inches thick. The subsoil is about 19 inches thick. The upper part is dark yellowish brown, friable loam; the next part is dark yellowish brown, friable sandy loam; the lower part is dark yellowish brown loamy sand. The substratum to a depth of about 60 inches is yellowish brown, loose sand that contains some gravel. In places the depth to sand and gravel is greater and the soil is not so droughty. In some areas the surface layer is thinner and contains less organic matter. In other areas the soil is moderately sloping.

This soil is moderately permeable in the upper part and very rapidly permeable in the substratum. Available water capacity is moderate to low. Surface runoff is medium. The content of organic matter is 2.5 to 3.5 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. Tilth is good.

Most areas are cultivated. This soil has fair potential for cultivated crops and for hay, pasture, and trees.

This soil is moderately suited to corn, soybeans, and small grain. It is suited to grasses and legumes for hay and pasture. It is droughty in years when rainfall is average or below average. If cultivated crops are grown, soil blowing is a hazard. Minimum tillage and winter cover crops help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition.

Capability subclass IIs.

184—Klinger silt loam, 1 to 3 percent slopes. This nearly level to gently sloping, somewhat poorly drained soil is on flat, broad divides, in concave areas at the head of drainageways, and on side slopes. Individual areas are irregular in shape and range from 2 to 80 acres in size.

Typically, the surface layer is about 9 inches of black silt loam over 9 inches of very dark brown and very dark grayish brown, friable silty clay loam. The subsoil is about 29 inches thick. The upper part is dark grayish brown, friable silty clay loam that has a few light olive brown mottles; the next part is grayish brown, friable silty clay loam mottled with light olive brown; the lower part is mottled yellowish brown and grayish brown, firm loam. Sand lenses are common at the boundary between the silty clay loam and the loam. The substratum to a depth of about 60 inches is mottled yellowish brown and light brownish gray, firm loam. In places a stone line separates the silty clay loam from the loam. In some areas the surface layer contains more sand.

This soil is moderately permeable. It is more rapidly permeable in the upper part of the subsoil than in the lower part or the substratum. Available water capacity is high. Surface runoff is slow to medium in cultivated areas. The content of organic matter is 5.0 to 6.0 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction varies in the surface layer as a result of local liming practices. The subsoil has a very low supply of available phosphorus and available potassium. Tilth is good.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay and pasture.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Though tile drainage is not needed in all areas, crops benefit and earlier fieldwork is possible if tile is installed. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability class I.

212—Kennebec silt loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on flood plains, in narrow upland drainageways, and on alluvial fans. Individual areas are irregular in shape and range from 10 to 90 acres in size.

Typically, the surface layer is about 8 inches of very dark brown silt loam over 47 inches of very dark brown and black, friable silt loam. The substratum to a depth of about 71 inches is very dark grayish brown, friable loam.

Included with this soil in mapping are small areas that are covered with 8 to 20 inches of light colored recent overwash.

Permeability is moderate, and available water capacity is high. Surface runoff is slow. The content of organic matter is 4.5 to 5.5 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction typically is slightly acid or neutral throughout the profile. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. Tilth is good.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Overflow during periods of heavy rain damages crops in some years. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth. Generally, no applications of lime are needed.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIw.

214D—Rockton loam, 20 to 30 inches to limestone, 5 to 14 percent slopes. This moderately sloping to strongly sloping, well drained soil is on side slopes in the uplands. Individual areas are irregular in shape and range from 5 to 30 acres in size.

Typically, the surface layer is very dark brown and very dark grayish brown loam about 14 inches thick. The subsoil is about 15 inches thick. The upper part is dark brown, friable loam; the next part is dark brown and reddish brown sandy clay loam; the thin lower part is yellowish red clay. Hard, fractured limestone bedrock is at a depth of about 29 inches. In some areas the surface layer is thinner and not so dark.

Included with this soil in mapping are some areas where limestone crops out.

Permeability is moderate, and available water capacity is low. The content of organic matter is 2.5 to 3.0 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The subsoil has a very low supply of available phosphorus and available potassium. Tilth is good.

Many areas are cultivated. This soil has fair to poor potential for cultivated crops and for hay, pasture, and trees.

This soil is poorly suited to corn, soybeans, and small grain, but it is suited to grasses and legumes for hay and pasture. It is droughty in years when rainfall is average or below average. If cultivated crops are grown, erosion is a hazard. Minimum tillage helps to prevent excessive soil loss. In many places contouring is beneficial. Terraces are not suitable because the soil is only moderately deep over limestone bedrock. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IVe.

220—Nodaway silt loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on flood plains, in narrow upland drainageways, and on alluvial fans. Individual areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The substratum to a depth of about 60 inches is dark grayish brown, grayish brown, and brown, friable silt loam.

Included with this soil in mapping are small areas of Arenzville soils. These soils formed in about 20 to 40 inches of recent alluvium over a dark colored buried soil.

Permeability is moderate in the Nodaway soil, and available water capacity is high. Surface runoff is slow. The content of organic matter is 2.0 to 3.0 percent in the surface layer. Reaction typically is slightly acid or neutral throughout the profile. The supply of available phosphorus and available potassium is medium in the subsoil. Tilth is good.

Many areas are cultivated. Inaccessible areas or areas in narrow drainageways are generally permanent pasture or woodland. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is subject to overflow, however, during periods of heavy rain. In some years crops are damaged. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth. Generally, no applications of lime are needed.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees. Tree seedlings can survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation or by spraying, cutting, and girdling.

Capability subclass IIw.

221—Palms muck, 1 to 3 percent slopes. This nearly level and gently sloping, very poorly drained soil generally is in broad upland drainageways and on the lower hillsides that are seepy and wet. In a few areas it is on stream benches. It is subject to ponding by runoff from adjacent areas. Individual areas are round or long and range from 2 to 20 acres in size.

Typically, the surface layer is black to very dark gray muck about 29 inches thick. The substratum to a depth of about 60 inches is very dark grayish brown and greenish gray silt loam.

Included with this soil in mapping are small areas that are covered with about 8 to 29 inches of light colored overwash. Also included are areas where the muck extends to a depth of only 10 inches.

Permeability is moderately rapid in the organic layer and moderate in the silty substratum. Available water capacity is high. Surface runoff is very slow. The content of organic matter is more than 20 percent in the surface layer. This layer typically is mildly alkaline. The subsoil has a very low supply of available phosphorus and available potassium. Tilth is fair.

Many areas have been drained and are cultivated. This soil has fair potential for cultivated crops and for hay and pasture.

If drained, this soil is suited to corn and soybeans and to grasses for hay and pasture. It has a very high water table and a hummocky surface. Row crops can be grown if tile or surface drainage is provided and the hummocks are leveled. Obtaining outlets for tile drainage is difficult in some areas. Considerable settling occurs after the soil is drained. If cultivated crops are grown, soil blowing is a hazard. Minimum tillage helps to prevent excessive soil loss. Generally, no applications of lime are needed. Undrained areas are best suited to wetland wildlife habitat.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIIw.

291—Atterberry silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on divides and at the head of drainageways and the base of slopes. Individual areas are irregular in shape and range from 5 to 40 acres in size.

Typically, the surface layer is very dark brown silt loam about 9 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is friable silty clay loam about 32 inches thick. The upper part is brown, the next part is grayish brown and has yellowish brown and strong brown mottles, and the lower part is mottled light brownish gray, yellowish brown, and strong brown. The substratum to a depth of about 62 inches is friable silt loam. The upper part is mottled light brownish gray and yellowish brown, and the lower part is light brownish gray and has strong brown mottles. In some small areas the surface layer is thinner.

Included with this soil in mapping are small areas of Walford soils. These soils are poorly drained.

Permeability is moderately slow in the Atterberry soil, and available water capacity is high. Surface runoff is slow. The content of organic matter is 2.5 to 3.5 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. Tilth is good. The surface layer puddles during intense rains. As a result, a crust that at times retards plant growth forms.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It has a seasonal high water table, especially in spring. If the soil is drained by tile, fieldwork can be more timely in years when rainfall is above normal. In areas at the base of slopes, this soil receives runoff and seepage from soils upslope. As a result, tile drainage generally is needed. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed.

Capability class I.

291B—Atterberry silt loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is at the head of drainageways and the base of slopes. Individual areas are irregular in shape and range from 5 to 50 acres in size.

Typically, the surface layer is about 9 inches of very dark brown silt loam mixed with some of the platy subsurface layer. The subsurface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is friable silty clay loam about 28 inches thick. The upper part is brown, the next part is grayish brown and has yellowish brown and strong brown mottles, and the lower part is mottled light brownish gray, yellowish brown, and strong brown. The substratum to a depth of about 60 inches is friable silt loam. The upper part is mottled light brownish gray and yellowish brown, and the lower part is light brownish gray and has strong brown mottles.

Permeability is moderate or moderately slow, and available water capacity is high. Surface runoff is slow to medium. The content of organic matter is 2.0 to 3.0 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. Tilth is good. The plow layer puddles during intense rains. As a result, a crust that at times retards plant growth forms.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard, however, in cultivated areas. Minimum tillage and winter cover crops help to prevent excessive soil loss. In most places contouring and terracing are beneficial. This soil receives runoff and seepage from soils upslope. Tile drainage generally is needed to remove seepage and to permit more timely fieldwork. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed.

Capability subclass IIe.

293C—Chelsea-Lamont-Fayette complex, 5 to 9 percent slopes. This map unit consists of moderately sloping soils on ridgetops and side slopes in the uplands. It is about 40 percent Chelsea soils, 30 percent Lamont soils, and 30 percent Fayette and other soils. These soils occur as areas so intricately mixed or so small that mapping them separately is not practical. Individual areas are 15 to 30 acres in size.

Typically, the excessively drained Chelsea soil has a surface layer of very dark gray and very dark grayish brown loamy fine sand about 5 inches thick. The subsurface layer is dark grayish brown, very dark grayish brown, dark brown, and yellowish brown, loose fine sand about 43 inches thick. Below this to a depth of 62 inches or more is yellowish brown, loose fine sand that has 1-inch bands of brown sandy loam.

Typically, the well drained Lamont soil has a surface layer of dark grayish brown fine sandy loam about 6 inches thick. The subsurface layer is dark grayish brown sandy loam about 3 inches thick. The subsoil is about 28 inches thick. The upper part is dark brown, friable loam; the next part is brown, friable sandy loam; the lower part is strong brown, very friable sandy loam and loamy sand. The substratum to a depth of 60 inches or more is light yellowish brown, loose fine sand or sand that has thin bands of brown loamy sand.

Typically, the well drained Fayette soil has a surface layer of very dark grayish brown silt loam about 5 inches thick. The subsurface layer is dark grayish brown and dark brown silt loam about 6 inches thick. The subsoil is friable silty clay loam about 45 inches thick. The upper part is dark brown, the next part is yellowish brown, and the lower part is dark yellowish brown and yellowish brown and has a few light brownish gray mottles. The substratum to a depth of 60 inches or more is yellowish brown, friable silt loam that has a few light brownish gray mottles.

Permeability is rapid in the Chelsea soil, moderately rapid in the Lamont soil, and moderate in the Fayette soil. Available water capacity is very low in the Chelsea soil, low to moderate in the Lamont soil, and high in the Fayette soil. Surface runoff is medium on all three soils. The content of organic matter is less than 1 percent in the surface layer. This layer ranges from slightly acid to strongly acid in uncultivated areas, but reaction varies widely in cultivated areas as a result of local liming practices. The supply of available phosphorus and available potassium is very low in the subsoil of the Chelsea soil and medium or very low in the subsoil of Lamont soil. The supply of available phosphorus is high in the subsoil of the Fayette soil and the supply of available potassium very low.

Many areas are pastured or wooded. A few are cultivated. These soils have poor potential for cultivated crops and fair potential for hay, pasture, and trees.

These soils are suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture, but they are droughty and low in fertility. Crop production and the carrying capacity of pasture are affected by the amount and timeliness of rain. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

If cultivated crops are grown, erosion is a hazard. Soil blowing is also a hazard on the Chelsea and Lamont soils. Minimum tillage helps to prevent excessive soil loss. In places contouring and terracing are beneficial. Terracing is suitable in a few areas that are dominantly Fayette soil, but the topography generally is not uniform and constructing terraces is difficult.

The use of these soils as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the Fayette soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition.

These soils are suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed.

Capability subclass IIIe.

293E—Chelsea-Lamont-Fayette complex, 9 to 18 percent slopes. This map unit consists of strongly sloping and moderately steep soils on ridgetops and side slopes in the uplands. It is made up of equal amounts of Chelsea, Lamont, and Fayette soils. These soils occur as areas so intricately mixed or so small that mapping them separately is not practical. Individual areas are 10 to 40 acres in size.

Typically, the excessively drained Chelsea soil has a surface layer of very dark gray and very dark grayish brown loamy fine sand about 3 inches thick. The subsurface layer is dark grayish brown, very dark grayish brown, dark brown, and yellowish brown, loose fine sand about 40 inches thick. Below this to a depth of 60 inches or more is yellowish brown, loose fine sand that has 1-inch bands of brown sandy loam.

Typically, the well drained Lamont soil has a surface layer of very dark grayish brown fine sandy loam about 5 inches thick. The subsurface layer is dark grayish brown sandy loam about 6 inches thick. The subsoil is about 26 inches thick. The upper part is dark brown, friable loam; the next part is brown, friable sandy loam; the lower part is strong brown, very friable sandy loam and loamy sand. The substratum to a depth of 60 inches or more is light yellowish brown, loose fine sand or sand that has thin bands of brown loamy sand.

Typically, the well drained Fayette soil has a surface layer of very dark grayish brown silt loam about 4 inches thick. The subsurface layer is dark grayish brown and dark brown silt loam about 6 inches thick. The subsoil is friable silty clay loam about 41 inches thick. The upper part is dark brown, the next part is yellowish brown, and the lower part is dark yellowish brown and yellowish brown and has a few light brownish gray mottles. The substratum to a depth of 60 inches or more is yellowish brown, friable silt loam that has a few light brownish gray mottles.

Included with these soils in mapping are small areas where the surface layer is mixed with the subsoil. In these areas fertility and the content of organic matter are lower.

Permeability is rapid in the Chelsea soil, moderately rapid in the Lamont soil, and moderate in the Fayette soil. Available water capacity is very low in the Chelsea soil, low to moderate in the Lamont soil, and high in the Fayette soil. Surface runoff is medium to rapid. The content of organic matter is less than 0.5 percent in the surface layer. This layer ranges from slightly acid to strongly acid in uncultivated areas, but reaction varies widely in cultivated areas as a result of local liming practices. The supply of available phosphorus and available potassium is very low in the subsoil of the Chelsea soil and medium or very low in the subsoil of the Lamont soil. The supply of available phosphorus is high in the subsoil of the Fayette soil and the supply of available potassium very low.

Many areas are pastured or wooded. A few are cultivated. These soils have poor potential for cultivated crops and fair potential for hay, pasture, and trees.

These soils are poorly suited to corn, soybeans, and small grain because they are droughty and low in fertility. Row crops generally are grown only to reestablish grass-legume hay and pasture. Crop production is affected by the amount and timeliness of rain. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

If cultivated crops are grown, erosion is a hazard. Also, the Chelsea and Lamont soils are subject to soil blowing and should be protected by a plant cover at all times. Minimum tillage and winter cover crops help to prevent excessive soil loss. In places contouring is beneficial. Constructing terraces is difficult because the topography is irregular and the sandy areas have poor stability.

The use of these soils as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the Fayette soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition.

These soils are suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed.

Capability subclass VIe.

293F—Chelsea-Lamont-Fayette complex, 18 to 40 percent slopes. This map unit consists of steep and very steep soils on side slopes in the uplands. It is made up of equal amounts of Chelsea, Lamont, and Fayette soils. These soils occur as areas so intricately mixed or so small that mapping them separately is not practical. Individual areas are 20 to 35 acres in size.

Typically, the excessively drained Chelsea soil has a surface layer of very dark gray and very dark grayish brown loamy fine sand about 3 inches thick. The subsurface layer is dark grayish brown, very dark grayish brown, dark brown, and yellowish brown, loose fine sand about 40 inches thick. Below this to a depth of 60 inches or more is yellowish brown, loose fine sand that has 1-inch bands of brown sandy loam.

Typically, the well drained Lamont soil has a surface layer of very dark grayish brown fine sandy loam about 3 inches thick. The subsurface layer is dark grayish brown sandy loam about 4 inches thick. The subsoil is about 24 inches thick. The upper part is dark brown, friable loam; the next part is brown, friable sandy loam; the lower part is strong brown, very friable sandy loam and loamy sand. The substratum to a depth of 60 inches or more is light yellowish brown, loose fine sand or sand that has thin bands of brown loamy sand.

Typically, the well drained Fayette soil has a surface layer of very dark grayish brown silt loam about 3 inches thick. The subsurface layer is dark grayish brown and dark brown, friable silt loam about 6 inches thick. The subsoil is friable silty clay loam about 34 inches thick. The upper part is dark brown, the next part is yellowish brown, and the lower part is dark yellowish brown and yellowish brown and has a few light brownish gray mottles. The substratum to a depth of 60 inches or more is yellowish brown, friable silt loam that has a few light brownish gray mottles.

Included with these soils in mapping are small areas where the surface layer is mixed with the subsoil. In these areas fertility and the content of organic matter are lower.

Permeability is rapid in the Chelsea soil, moderately rapid in the Lamont soil, and moderate in the Fayette soil. Available water capacity is very low in the Chelsea soil, low to moderate in the Lamont soil, and high in the Fayette soil. Surface runoff is rapid on all three soils. The content of organic matter is less than 0.5 percent in the surface layer. In uncultivated areas this layer ranges from slightly acid to strongly acid, but reaction varies widely in cultivated areas as a result of local liming practices. The supply of available phosphorus and available potassium is very low in the subsoil of the Chelsea soil and medium or very low in the subsoil of the Lamont soil. The supply of available phosphorus is high in the subsoil of the Fayette soil and the supply of available potassium very low.

Most areas are pastured or wooded. A few are cultivated. These soils have poor potential for cultivated crops and for hay and pasture and fair potential for trees.

These soils are poorly suited to corn, soybeans, small grain, and hay because they are steep and very steep, droughty, and low in fertility. They are moderately well suited to poorly suited to permanent pasture. The slopes and the waterways hinder farm machinery. Applying fertilizer and lime is difficult on these steep and very steep slopes.

If cultivated crops are grown, erosion is a severe hazard. Also, the Chelsea and Lamont soils are subject to soil blowing and should be protected by a plant cover at all times. Minimum tillage helps prevent excessive soil loss.

The use of these soils as pastureland or hayland is effective in controlling erosion, but grazing should be limited. Overgrazing or grazing when the Fayette soil is too wet results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition. Renovating pasture is difficult because of the steep and very steep slopes. The carrying capacity of pasture is affected by the amount and timeliness of rain, especially on the Chelsea and Lamont soils.

All three soils are suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed.

Capability subclass VIIe.

315—Loamy alluvial land-Spillville complex, 0 to 2 percent slopes. This map unit consists of nearly level areas of Loamy alluvial land and moderately well drained and somewhat poorly drained Spillville soils on the flood plains along the larger streams and their tributaries. It is subject to frequent flooding (fig. 13). It is about 40 percent Loamy alluvial land, 30 percent Spillville soils, and 30 percent other soils. Individual areas are long and narrow, wide, or irregularly shaped and range from 100 to more than 500 acres in size. Rivers, streams, or old stream channels cut through most areas.

Loamy alluvial land occurs as old channels, low natural levees, small ponds, sloughs, and small oxbows. It mainly consists of material that has been recently deposited by rivers. This material is highly stratified sediment that has not been in place long enough for the formation of a uniform sequence of horizons. Typically, it is sandy loam or loamy sand and has strata of silt loam and silty clay loam. In some small areas it has a uniform texture.

Typically, the Spillville soil has a surface layer of very dark brown and very dark grayish brown, friable loam about 40 inches thick. The substratum to a depth of about 60 inches is dark grayish brown sandy loam and dark brown loamy sand.

Included in this unit in mapping are small areas of Arenzville, Colo, Hanlon, Kennebec, Nodaway, and Sawmill soils and Marsh. Arenzville, Colo, Kennebec, Nodaway, and Sawmill soils formed in silty alluvium. They occur as areas that are intermingled with areas of the Spillville soil. Marsh is in depressional areas and is very poorly drained. Hanlon soils are sandy throughout.

Permeability and available water capacity vary on Loamy alluvial land. Reaction generally is neutral or slightly acid. In many places this land is wet because of flooding, impounded water, and a high water table after periods of flooding.

The Spillville soil is moderately permeable. Available water capacity is high. The content of organic matter is 4.5 to 5.5 percent in the surface layer. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. Tilth is good.

Many areas are woodland and permanent pasture. Some have been cleared and are cultivated. This map unit has poor potential for cultivated crops because of the periodic flooding. It has fair potential for grasses, wild herbaceous plants, wetland plants, and trees. The potential for development of habitat for woodland and wetland wildlife is fair.

Unless protected by levees, this map unit is poorly suited to corn, soybeans, and small grain. Land leveling and surface drainage are needed before farm machinery

Figure 13.—An area of Loamy alluvial land-Spillville complex, 0 to 2 percent slopes, partly flooded by the Cedar River.

can cross some of the oxbows and sloughs. Even in drained areas, a crop can be lost as a result of the flooding and the deposition of recent material on the plants.

Grazing pasture when the soil is too wet results in surface compaction and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass Vw.

320—Arenzville silt loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on flood plains and in narrow upland drainageways along the base of eroded hillsides. It is subject to flooding by runoff from adjacent areas. Individual areas are long or irregularly shaped and range from 5 to 35 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The substratum, to a depth of about 28 inches, is dark grayish brown and brown, friable silt loam. The next layer is an older buried surface layer of black silt loam about 12 inches thick. Below this to a depth of about 60 inches is very dark gray and dark gray, friable silty clay loam.

Included with this soil in mapping are small areas of Colo silt loam, overwash. In some years this included soil is wetter than the Arenzville soil during rainy periods.

Permeability is moderate in the Arenzville soil, and available water capacity is high. Surface runoff is slow. The content of organic matter is 2.0 to 3.0 percent in the surface layer. This layer is slightly acid or neutral. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. Tilth is good.

Many areas are cultivated. Inaccessible areas or areas in narrow drainageways generally are permanent pasture or woodland. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is

subject to overflow, however, during periods of high rainfall. The water or the deposition of new material damages crops in some years. Properly located diversions on soils upslope provide some protection from local runoff and control siltation. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth. Generally, no applications of lime are needed.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation or by spraying, cutting, and girdling.

Capability subclass IIw.

350B—Waukegan silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on stream benches and in a few areas on the adjoining uplands. Individual areas are irregular in shape and range from 5 to 30 acres in size.

Typically, the surface layer is very dark brown silt loam about 18 inches thick. The subsoil is about 26 inches thick. The upper part is dark brown, friable silty clay loam, and the lower part is dark yellowish brown, friable loam over dark yellowish brown, very friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose loamy sand and fine gravel. In places the soil is nearly level.

Permeability is moderate in the upper part of the subsoil and rapid in the lower part and the substratum. Available water capacity is moderate. Surface runoff is slow to medium. The content of organic matter is 3.0 to 4.0 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction varies in the surface layer as a result of local liming practices. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. Tilth is good.

Most areas are cultivated. This soil has fair potential for cultivated crops and for hay, pasture, and trees.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is somewhat droughty, however, even in years of normal rainfall. Also, erosion is a hazard in cultivated areas. Minimum tillage helps to prevent excessive soil loss. In places contouring and terracing are beneficial. If terraces are constructed, the cuts should not expose the sand and gravel. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIe.

350C—Waukegan silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on uplands. Individual areas are irregular in shape and range from 3 to 40 acres in size.

Typically, the surface layer is very dark brown silt loam about 18 inches thick. The subsoil is about 26 inches thick. The upper part is dark brown, friable silty clay loam, and the lower part is dark yellowish brown, friable loam over dark yellowish brown, very friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose loamy sand and fine gravel. In some small areas that are moderately eroded, the surface layer is thinner and contains less organic matter.

Permeability is moderate in the upper part of the subsoil and rapid in the lower part and the substratum. Available water capacity is moderate. Surface runoff is medium. The content of organic matter is 2.5 to 3.5 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction varies in the surface layer as a result of local liming practices. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. Tilth is good.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is somewhat droughty, however, even in years of normal rainfall. Also, erosion is a hazard in cultivated areas. Minimum tillage helps to prevent excessive soil loss. In places contouring and terracing are beneficial. If terraces are constructed, the cuts should not expose the sand and gravel. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIIe.

352B—Whittier silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on stream benches and in the uplands. Individual areas are irregular in shape and range from 3 to 35 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 2 inches thick. The subsoil is about 27 inches thick. The upper part is dark yellowish brown, friable silty clay loam; the next part is yellowish brown, friable silty clay loam; the lower part is yellowish brown, friable sandy clay loam. The substratum to a depth of about 60 inches is yellowish brown, loose fine sand and sand. In some small areas the surface layer is thinner and contains less organic matter. In other small areas, silty material extends to a depth of more than 40 inches and available water capacity is slightly higher.

Permeability is moderate in the upper part of the subsoil and rapid in the lower part and in the substratum. Available water capacity is moderate. Surface runoff is medium. The content of organic matter is 2.0 to 3.0 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction varies in the surface layer as a result of local liming practices. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. Tilth is good.

Most areas are cultivated. This soil has fair potential for cultivated crops and for hay, pasture, and trees.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It can be droughty, however, in years when rainfall is below normal. Also, erosion is a hazard in cultivated areas. Minimum tillage helps to prevent excessive soil loss. In places contouring and terracing are beneficial. If terraces are constructed, the cuts should not expose the sandy material. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation or by spraying, cutting, and girdling.

Capability subclass IIe.

352C2—Whittier silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on convex side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 15 acres in size.

Typically, the surface layer is about 8 inches of dark grayish brown silt loam mixed with some of the dark yellowish brown silty clay loam from the subsoil. The subsoil is about 22 inches thick. The upper part is dark yellowish brown, friable silty clay loam; the next part is yellowish brown, friable silty clay loam; the lower part is yellowish brown, friable sandy clay loam. The substratum to a depth of about 60 inches is yellowish brown, loose fine sand and sand. In some small areas the dark colored surface layer is thicker and contains more organic matter. In other areas it is thinner and contains less organic matter.

Permeability is moderate in the upper part of the subsoil and rapid in the lower part and in the substratum. Available water capacity is moderate. Surface runoff is medium. The content of organic matter is 1.5 to 2.0 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. Tilth is good.

Most areas are cultivated. This soil has poor potential for cultivated crops and for hay, pasture, and trees.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It can be droughty, however, in years when rainfall is below normal. Also, futher erosion is a hazard in cultivated areas. Minimum tillage helps to prevent excessive soil loss. In places contouring and terracing are beneficial. If terraces are constructed, the cuts should not expose the sandy material. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation, by prescribed burning, or by cutting and girdling.

Capability subclass IIIe.

354—Marsh. This map unit occurs as depressional areas on bottom land and low benches adjacent to the major streams and rivers or as shallow, depressional areas on uplands. It is subject to ponding by runoff from adjacent areas. Individual areas are irregular in shape and range from 2 to 200 acres in size.

Areas of Marsh lack distinct soil layers. In most areas either small ponds are evident or the water table is at or near the surface the year round.

Unless drained, this map unit is not suited to corn, soybeans, or small grain or to grasses and legumes for hay and pasture. Providing drainage commonly is very

difficult because good outlets are not available. Most areas are suitable as wetland wildlife habitat.

Capability subclass VIIw.

377B—Dinsdale silt loam, 2 to 5 percent slopes. This gently sloping, well drained and moderately well drained soil is on slightly convex ridge crests and side slopes. Individual areas are irregular in shape and range from 5 to 150 acres in size.

Typically, the surface layer is about 11 inches of very dark brown and very dark grayish brown silt loam over 4 inches of very dark grayish brown silty clay loam. The subsoil is about 45 inches thick. The upper part is dark brown and dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable or firm loam that has a few light brownish gray mottles below a depth of 36 inches. The substratum to a depth of about 70 inches is yellowish brown, firm, calcareous loam mottled with light brownish gray.

This soil is moderately permeable. It is more rapidly permeable in the upper part of the subsoil than in the lower part or the substratum. Available water capacity is high. Surface runoff is medium. The content of organic matter is 3.0 to 4.0 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction varies in the surface layer as a result of local liming practices. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. Tilth is good.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard, however, in cultivated areas. Minimum tillage helps to prevent excessive soil loss. In most places contouring and terracing are beneficial. If terraces are constructed, the cuts should not expose the glacial till subsoil, which is lower in fertility. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIe.

377C—Dinsdale silt loam, 5 to 9 percent slopes. This moderately sloping, well drained and moderately well drained soil is on convex side slopes. Individual areas are irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is about 11 inches of very dark brown and very dark grayish brown silt loam over 4 inches of very dark grayish brown silty clay loam. The subsoil is about 44 inches thick. The upper part is dark brown and dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable or firm loam that has a few light brownish gray mottles below a depth of 36 inches. The substratum to a depth of about 70 inches is yellowish brown, firm, calcareous loam mottled with light brownish gray. In some areas the surface layer is silty clay loam.

This soil is moderately permeable. It is more rapidly permeable in the upper part of the subsoil than in the lower part or the substratum. Available water capacity is high. Surface runoff is medium in cultivated areas. The content of organic matter is 3.0 to 3.5 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. Tilth is good.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard, however, in cultivated areas. Minimum tillage helps to prevent excessive soil loss. In most places contouring and terracing are beneficial. If terraces are constructed, the cuts should not expose the glacial till subsoil, which is lower in fertility. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIIe.

377C2—Dinsdale silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained and moderately well drained soil is on convex side slopes in the uplands. Individual areas are irregular in shape and range from 5 to 25 acres in size.

Typically, the surface layer is about 9 inches of very dark grayish brown silt loam and silty clay loam mixed with some of the dark brown silty clay loam from the subsoil. The subsoil is about 37 inches thick. The upper part is dark brown and dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable or firm loam that has a few light brownish gray mottles below a depth of 36 inches. The substratum to a depth of 60 inches or more is yellowish brown, firm, calcareous loam mottled with light brownish gray.

This soil is moderately permeable. It is more rapidly permeable in the upper part of the subsoil than in the lower part or the substratum. Available water capacity is high. Surface runoff is medium. The content of organic

matter is 2.0 to 2.5 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. Tilth is good.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Further erosion is a hazard, however, in cultivated areas. Minimum tillage helps to prevent excessive soil loss. In most places contouring and terracing are beneficial. If terraces are constructed, the cuts should not expose the glacial till subsoil, which is lower in fertility. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIIe.

382—Maxfield silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is in slight depressions and shallow drainageways in the uplands. Individual areas are long or irregularly shaped and range from 5 to several hundred acres in size.

Typically, the surface layer is black and very dark gray silty clay loam about 23 inches thick. The subsoil is about 31 inches thick. The upper part is grayish brown, friable silty clay loam that has many yellowish brown mottles, and the lower part is mottled yellowish brown and light brownish gray, firm loam. The substratum to a depth of about 70 inches is mottled yellowish brown and light brownish gray, firm loam. In places a stone line or sand lenses separate the silty clay loam from the loam.

Included with this soil in mapping are areas where more than 10 inches of sandy loam or loamy sand lenses is between the silty clay loam and the loam.

This soil is moderately permeable. It is more rapidly permeable in the upper part of the subsoil than in the lower part or the substratum. Available water capacity is high. Surface runoff is slow, and water ponds for short periods in some low areas. The content of organic matter is 6.0 to 7.0 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction typically is neutral in the surface layer. The subsoil has a very low supply of available phosphorus and available potassium. Tilth is good, but the soil puddles after heavy rains and crusts if tilled when wet.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay and pasture.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. In some areas artificial drainage is needed to lower the water table and improve the timeliness of fieldwork. Inadequately drained areas generally are pastured. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth. Generally, no applications of lime are needed.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIw.

412E—Sogn loam, 9 to 18 percent slopes. This strongly sloping and moderately steep, somewhat excessively drained soil is on short, convex side slopes on uplands. Individual areas are somewhat long or irregularly shaped and range from 5 to 20 acres in size.

Typically, the surface layer is black and very dark brown loam about 12 inches thick. Shattered limestone is at a depth of about 12 inches. It is underlain by hard limestone bedrock. In cultivated areas the surface layer is very dark brown and very dark grayish brown loam.

Included with this soil in mapping are areas where the surface layer is sandy loam or silt loam and areas where the limestone is closer to the surface. Also included are small areas where the slope is more than 18 percent.

Permeability is moderate, and available water capacity is very low. Surface runoff is rapid in cultivated areas. The content of organic matter is 1.5 to 2.5 percent in the surface layer. Reaction is typically neutral throughout the profile. The subsoil has a very low supply of available phosphorus and available potassium. Tilth is good.

Most areas are pastureland or hayland. This soil has poor potential for cultivated crops and trees and good potential for grasses and legumes for hay and pasture.

This soil is not well suited to corn, soybeans, and small grain. It is droughty. Also, erosion is a hazard if cultivated crops are grown. Minimum tillage helps to prevent excessive soil loss. In places contouring is beneficial. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth. Generally, no applications of lime are needed.

This soil is best suited to hay and pasture. Using the soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition. Pasture renovation is difficult because the soil is strongly sloping and shallow to bedrock and has limestone slabs on the surface.

Capability subclass VIIs.

420B—Tama silt loam, benches, 2 to 5 percent slopes. This gently sloping, well drained soil is on loess-covered stream benches. Individual areas are irregular in shape and range from 2 to 25 acres in size.

Typically, the surface layer is about 6 inches of very dark brown silt loam over 7 inches of very dark brown silty clay loam. The subsoil is friable silty clay loam about 34 inches thick. The upper part is dark brown, the next part is dark yellowish brown, and the lower part is yellowish brown. The substratum is yellowish brown, friable silt loam mottled with light gray and strong brown. Stratified sand is below a depth of 5 to 8 feet. In places it is as shallow as 4 feet. A few areas are moderately sloping, and other areas are both moderately sloping and moderately eroded. In the eroded areas the surface layer contains less organic matter. Some small areas are nearly level.

Permeability is moderate, and available water capacity is high. Surface runoff is medium. The content of organic matter is 3.0 to 4.0 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction varies in the surface layer as a result of local liming practices. The subsoil has a low supply of available phosphorus and available potassium. Tilth is good.

Most areas are cultivated. Some are permanent pasture or hayland. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard, however, in cultivated areas. Minimum tillage helps to prevent excessive soil loss. Many areas are well suited to contouring and terracing because the slopes are uniform. Terraced areas can be planted to row crops without excessive soil losses more often than areas where other conservation measures are applied. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIe.

428B—Ely silt loam, 2 to 5 percent slopes. This moderately sloping, somewhat poorly drained soil occurs as long, narrow bands at the foot of hillsides or on alluvial fans where waterways empty onto bottom land. Individual areas range from 5 to 50 acres in size.

Typically, the surface layer is about 8 inches of very dark brown silt loam over 17 inches of black or very dark grayish brown silty clay loam. The subsoil is silty clay loam about 23 inches thick. The upper part is dark grayish brown and has a few dark brown mottles, the next part is olive brown and has a few yellowish brown mottles, and the lower part is light olive brown and grayish brown and has yellowish brown and strong brown mottles. The substratum to a depth of about 63 inches is light olive brown silt loam mottled with strong brown and grayish brown.

Included with this soil in mapping are small areas of Judson silt loam, which is well drained or moderately well drained.

Permeability is moderate in the Ely soil, and available water capacity is high. Surface runoff is medium in cultivated areas. The content of organic matter is 5.0 to 6.0 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction varies in the surface layer as a result of local liming practices. The subsoil has a very low supply of available phosphorus and available potassium. Tilth is good.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard, however, in cultivated areas. Minimum tillage helps to prevent excessive soil loss. Interceptor tile can remove the water that seeps in from adjacent slopes. Areas where runoff concentrates are subject to gullying. Diversions can intercept the runoff. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIe.

442C—Dickinson-Tama complex, 4 to 10 percent slopes. This map unit consists of gently sloping to strongly sloping soils on ridgetops and side slopes in the uplands. Many of the ridges are oriented from northwest to southeast. The unit is about 50 percent Dickinson soils, 30 percent Tama soils, and 20 percent other soils. These soils occur as areas so intricately mixed or so small that mapping them separately is not practical. Areas range from 10 to 50 acres in size.

Typically, the surface layer of the well drained or somewhat excessively drained Dickinson soil is about 7 inches of very dark brown fine sandy loam over 11 inches of very dark grayish brown and dark brown, very friable sandy loam. The subsoil is about 22 inches thick. The upper part is dark brown, very friable sandy loam, and the lower part is strong brown, very friable loamy

sand. The substratum to a depth of about 60 inches is yellowish brown, loose sand.

Typically, the well drained Tama soil has a surface layer of very dark brown silt loam or silty clay loam about 13 inches thick. The subsoil is friable silty clay loam about 30 inches thick. The upper part is dark brown, the next part is dark yellowish brown, and the lower part is yellowish brown. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam mottled with light gray and strong brown.

Permeability is moderately rapid or rapid in the Dickinson soil and moderate in the Tama soil. Available water capacity is moderate in the Dickinson soil and high in the Tama soil. Surface runoff is medium on both soils. The content of organic matter is 0.5 to 3.0 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The subsoil of the Dickinson soil has a very low supply of available phosphorus and available potassium. That of the Tama soil has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. These soils have fair potential for cultivated crops and for hay, pasture, and trees.

These soils are moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. The Dickinson soil is droughty; yields are low unless rainfall is very timely. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If cultivated crops are grown, water erosion and soil blowing are hazards. Windblown sand from the Dickinson soil sometimes damages newly seeded crops on these soils and on adjoining soils unless the surface is protected by a plant cover. Minimum tillage and winter cover crops help to prevent excessive soil loss. In places contouring is beneficial, but constructing or maintaining terraces is difficult on the Dickinson soil.

The use of these soils as pastureland or hayland is effective in controlling erosion and soil blowing. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIIe.

462B—Downs silt loam, benches, 2 to 5 percent slopes. This gently sloping, well drained soil is on loess-covered stream benches. Individual areas are irregular in shape and range from 2 to 15 acres in size.

Typically, the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 3 inches thick. The subsoil is about 39 inches thick. The upper part is dark brown, friable silt loam; the next part is dark yellowish brown and yellowish brown, friable silty clay loam; and the lower part is mottled light brownish gray and yellowish brown, friable silty clay loam. The substratum is mottled light brownish gray and yellowish brown, friable silt loam. Stratified sand is below a depth of 5 to 8 feet. In places it is as shallow as 4 feet. A few areas are moderately sloping, and other areas are both moderately sloping and moderately eroded. In the eroded areas the surface layer contains less organic matter. Some small areas are nearly level.

Permeability is moderate, and available water capacity is high. Surface runoff is medium. The content of organic matter is 2.0 to 3.0 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The supply of available phosphorus is medium in the subsoil and the supply of available potassium very low. Tilth is good, but the soil tends to crust after heavy rains.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard, however, in cultivated areas. Minimum tillage helps to prevent excessive soil loss. Some areas are well suited to contouring and terracing. Terraced areas can be planted to row crops without excessive soil loss more often than areas where other conservation measures are applied. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation or by spraying, cutting, and girdling.

Capability subclass IIe.

463B—Fayette silt loam, benches, 2 to 5 percent slopes. This gently sloping, well drained soil is on loess-covered stream benches. Individual areas are irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is friable silty clay loam about 47 inches thick. The upper part is dark brown, the next part is yellowish brown, and the lower part is dark yellowish brown and yellowish brown and has a few light brownish gray mottles. The substratum is yellowish brown, friable silt loam that has a few light brownish gray mottles. Stratified sand is below a depth of 5 to 8 feet. In places it is as shallow as 4 feet. A few areas are moderately sloping, and other areas are moderately sloping and moderately eroded. In the eroded

areas the surface layer contains less organic matter. Some small areas are nearly level.

Permeability is moderate, and available water capacity is high. Surface runoff is medium. The content of organic matter is 1.5 to 2.0 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The supply of available phosphorus is high in the subsoil and the supply of available potassium very low. Tilth is good. The soil tends to puddle and crust, however, after heavy rains. As a result, the runoff rate is increased and plant growth retarded.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to legumes for hay and pasture. Erosion is a hazard, however, in cultivated areas. Minimum tillage helps to prevent excessive soil loss. In most places contouring and terracing are beneficial. Terraced areas can be planted to row crops without excessive soil loss more often than areas where other conservation measures are applied. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation or by spraying, cutting, and girdling.

Capability subclass IIe.

467—Radford silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on flood plains and in narrow upland drainageways. It is subject to flooding by runoff from adjacent areas. Individual areas are irregular in shape and range from 10 to 80 acres in size.

Typically, the surface layer is very dark grayish brown and very dark gray silt loam about 12 inches thick. The substratum is very dark gray, friable silt loam about 14 inches thick. Below this is a buried surface layer of black silty clay loam about 20 inches thick. The buried subsoil is very dark gray and olive gray, firm silty clay loam about 20 inches thick.

Included with this soil in mapping are small areas of Colo silt loam, overwash. This included soil has a thinner silt loam surface layer than the Radford soil. Also, it can be wetter during the early part of the year.

Permeability is moderate in the Radford soil, and available water capacity is high. Surface runoff is slow to medium. The content of organic matter is 4.0 to 5.0 percent in the surface layer. Most of this organic matter is in the plow layer. The surface layer ranges from slightly acid to mildly alkaline. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. Tilth is good.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is subject to overflow, however, during periods of high rainfall. Either the water or deposition damages crops in some years. The soil can have a seasonal high water table. In most areas tile is needed to improve drainage. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth. Generally, no applications of lime are needed.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIw.

478G—Rock outcrop-Sogn complex, 25 to 60 percent slopes. This map unit consists of outcrops of limestone bedrock and areas of Sogn soils. These very steep areas are on sharp slope breaks between stream benches or on bottom land and uplands. Individual areas are narrow or irregularly shaped and range from 7 to 85 acres in size. This unit is about 50 percent Rock outcrop, 30 percent Sogn soils, and 20 percent other soils.

Rock outcrop has no soil profile. It is covered with a very thin layer of loam or silt loam in some areas. Limestone fragments cover much of the surface.

Typically, the somewhat excessively drained Sogn soil has a surface layer of black and very dark brown loam about 12 inches thick. Limestone is at a depth of about 12 inches.

Permeability is moderate in the Sogn soil, and available water capacity is very low. Surface runoff is rapid on this unit. The Sogn soil typically is neutral. It has a very low supply of available phosphorus and available potassium in the subsoil.

All areas are permanently pastured or are wooded. This map unit has poor potential for cultivated crops and for hay, pasture, and trees.

This map unit is not suited to corn, soybeans, small grain, or hay. Ordinary farm machinery cannot be used because of the very steep slope and the outcrops of limestone. Applying fertilizer and lime is difficult.

This map unit is poorly suited to permanent pasture. Grazing should be limited. Overgrazing results in surface compaction, an increased runoff rate, and a susceptibility to gullying. Proper stocking rates, pasture rotation, and

timely deferment of grazing keep the soil in good condition and reduce the risk of erosion.

Capability subclass VIIs.

485—Spillville loam, 0 to 2 percent slopes. This nearly level, moderately well drained and somewhat poorly drained soil is on the bottom land along the major rivers and small streams and along drainageways. It is subject to flooding. Individual areas are long or irregularly shaped and range from 15 to 100 acres in size.

Typically, the surface layer is very dark brown, black, and very dark grayish brown, friable and very friable loam about 40 inches thick. The substratum to a depth of about 60 inches is dark grayish brown sandy loam and dark brown loamy sand.

Included with this soil in mapping are small areas that are covered with 8 to 20 inches of light colored recent overwash. Also included are small sandy areas that are lower in content of organic matter and less fertile.

Permeability is moderate, and available water capacity is high. Surface runoff is slow. The content of organic matter is 4.5 to 5.5 percent in the surface layer. Reaction typically is slightly acid or neutral throughout most of the profile. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. Tilth is good.

Many areas are cultivated. Most areas that are inaccessible or are in narrow drainageways are permanent pasture or woodland. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is suited to corn, soybeans, and small grain. It is also suited to grasses and legumes for hay and pasture if it is protected from floodwater. Crop production is reduced in some years because the soil is subject to flooding during periods of heavy rain. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth. Generally, no applications of lime are needed.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIw.

536—Hanlon fine sandy loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on low benches, natural levees, and bottom land along the larger streams and rivers. It is subject to flooding. Individual areas are irregular in shape and range from 5 to 50 acres in size.

Typically, the surface layer is very dark brown and very dark grayish brown, very friable fine sandy loam about 42 inches thick. The substratum to a depth of about 60 inches is dark brown, very friable loamy fine sand. In some small areas the surface layer is loamy sand.

Permeability is moderately rapid, and available water capacity is moderate. Surface runoff is slow. The content of organic matter is 4.0 to 5.0 percent in the surface layer. Most of this organic matter is in the plow layer. The surface layer is typically neutral or slightly acid. The lower part of the surface layer has a very low supply of available phosphorus and available potassium. Tilth is good.

Many areas are cultivated. A few are permanent pasture. This soil has fair potential for cultivated crops and poor potential for trees.

This soil is suited to corn and soybeans and to grasses and legumes for hay and pasture if it is protected from floodwater. It is subject to occasional flooding during periods of heavy rain. It can be droughty in years when the rainfall is below average or is not timely. Minimum tillage and winter cover crops conserve moisture. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth. Generally, no applications of lime are needed.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIs.

729B—Nodaway-Arenzville silt loams, 2 to 5 percent slopes. This map unit consists of gently sloping, moderately well drained soils on narrow bottom land and in drainageways that extend into the highly dissected loess-covered uplands. It is about 50 percent Nodaway soils, 40 percent Arenzville soils, and 10 percent other soils. The major soils are subject to flooding. They occur as areas so intricately mixed or so small that mapping them separately is not practical. Individual areas range from 15 to 200 acres in size.

Typically, the Nodaway soil has a surface layer of very dark grayish brown silt loam about 7 inches thick. The substratum to a depth of about 60 inches is dark grayish brown, grayish brown, and brown, stratified, friable silt loam.

Typically, the Arenzville soil has a dark grayish brown loam surface layer about 6 inches thick. The substratum is dark grayish brown and brown, friable silt loam about 22 inches thick. The next layer is an older buried surface layer of black silt loam about 12 inches thick. Below this to a depth of about 60 inches is very dark gray and dark gray, friable silty clay loam.

Included with these soils in mapping are small areas of Colo silt loam, overwash, where the recent overwash is less than 20 inches deep over black silty clay loam. Also included are other small areas where the recently deposited material is more poorly drained than the Nodaway and Arenzville soils.

These soils are moderately permeable. Available water capacity is high. Surface runoff is slow. The Nodaway soil typically is neutral, and the Arenzville soil is slightly acid to neutral. The subsoil of the Nodaway soil has a medium supply of available phosphorus and available potassium. That of the Arenzville soil has a low supply of available phosphorus and a very low supply of available potassium.

Many areas are pastured or wooded. Some are cultivated. These soils have fair potential for cultivated crops and for hay, pasture, and trees.

These soils are suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Flooding and gullying are hazards, however, if cultivated crops are grown. Some small areas are dissected by one or more gullies or waterways. In some places the gullying can be controlled by shaping and seeding waterways. In other places structures that keep gullies from forming also are needed.

In many areas these soils are in very narrow drainageways that are flooded. In these areas they cannot be cultivated and are wooded or permanently pastured. In the larger areas the soils can be cultivated, but the excess water from the hillsides should be diverted. In some areas that are seasonally wet because of seepage from upland soils, the installation of tile drainage permits timely fieldwork. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth. Generally, no applications of lime are needed.

The use of these soils as pastureland and hayland helps to control erosion or gullying. Overgrazing or grazing when the soils are too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation or by spraying, cutting, and girdling.

Capability subclass IIe.

760—Ansgar silt loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is in flat or depressional areas or in shallow drainageways. Individual areas are irregular in shape and range from 3 to 25 acres in size.

Typically, the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer is grayish brown, friable silt loam about 11 inches thick. The subsoil is about 41 inches thick. The upper part is grayish brown, friable silty clay loam mottled with yellowish brown; the next part is gray, firm silty clay loam mottled with dark brown; the lower part is mottled grayish brown and strong brown, firm loam over mottled yellowish brown and light brownish gray, firm sandy clay loam. Sand lenses are common at the junction of the loess and till.

Included with this soil in mapping are areas of the somewhat poorly drained Franklin soils. Also included are areas where depth to the loam glacial till is more than 40 inches.

This soil is moderately permeable. It is more rapidly permeable in the upper part of the subsoil than in the lower part or the substratum. Available water capacity is high. Surface runoff is very slow, and the soil is subject to ponding. The content of organic matter is 2.0 to 4.0 percent in the surface layer. Reaction in this layer varies as a result of local liming practices. The subsoil has a very low supply of available phosphorus and available potassium. Tilth is good unless the soil is worked when wet.

Many areas are cultivated. A few areas are permanent pasture or wildlife habitat. This soil has fair potential for cultivated crops and for hay and pasture.

If drained, this soil is suited to corn, soybeans, and small grain. It is also suited to grasses and legumes for hay and pasture. In some areas ponded water drowns out crops. Tile and surface drains are needed in cultivated areas. Some areas cannot be satisfactorily drained by tile. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIw.

761—Franklin silt loam, 1 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is on the flat, broad divides or in concave areas at the head of drainageways. Individual areas are irregular in shape and range from 2 to 50 acres in size.

Typically, the surface layer is very dark gray silt loam about 9 inches thick. The subsurface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is about 46 inches thick. The upper part is dark grayish brown and grayish brown, friable silty clay loam mottled with yellowish brown and strong brown, and the lower part is yellowish brown, firm loam mottled with light brownish gray. Sand lenses are common at the junction of the silty clay loam and the loam. In places the surface layer has a slightly higher content of sand.

Included with this soil in mapping are small areas of the poorly drained Ansgar soils.

This soil is moderately permeable. It is more rapidly permeable in the upper part of the subsoil than in the lower part or the substratum. Available water capacity is high. Surface runoff is slow to medium in cultivated

areas. The content of organic matter is 2.5 to 3.5 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. Tilth is good. The plow layer tends to puddle during intense rains, forming a crust that sometimes retards plant growth.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Tile drainage is not needed in all areas, but crops can benefit and earlier fieldwork is possible if tile is installed. If row crops are intensively grown in the gently sloping areas, a combination of erosion control and tile drainage is needed. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation or by spraying, cutting, and girdling.

Capability class I.

771B—Waubeek silt loam, 2 to 5 percent slopes. This gently sloping, moderately well drained and well drained soil is on convex ridges and side slopes. Individual areas are irregular in shape and range from 10 to 80 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is about 33 inches thick. The upper part is dark brown and yellowish brown, friable silty clay loam, and the lower part is yellowish brown, firm loam that has a few grayish brown and gray mottles. The substratum to a depth of about 70 inches is yellowish brown, firm loam mottled with gray. In places a stone line separates the silty clay loam from the loam. Sand lenses are common at the junction of the silty clay loam and loam. In some areas the surface layer contains more sand, and in some it is less than 6 inches thick.

Included with this soil in mapping are small areas of Downs soils, which are silty to a depth of more than 40 inches.

This soil is moderately permeable. It is more rapidly permeable in the upper part of the subsoil than in the lower part or the substratum. Available water capacity is high. Surface runoff is medium in cultivated areas. The content of organic matter is 2.0 to 3.0 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil has a medium supply of available phosphorus and a very low supply of available potassium. Tilth is good.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard, however, in cultivated areas. Minimum tillage helps to prevent excessive soil loss. In many places contouring and terracing are beneficial. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The use of this soil as pastureland or hayland is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation or by spraying, cutting, and girdling.

Capability subclass IIe.

933—Sawmill silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on alluvial flood plains and in narrow drainageways in the uplands. It is subject to the flooding that occurs as overflow from the major streams and as runoff from adjacent higher lying areas. Individual areas are long or irregularly shaped and range from 10 to several hundred acres in size.

Typically, the surface layer is black and very dark gray silty clay loam about 33 inches thick. The subsoil is about 12 inches of olive gray and dark gray, firm silty clay loam mottled with yellowish brown. The substratum to a depth of about 60 inches is light olive gray, friable silt loam mottled with strong brown.

Permeability is moderate, and available water capacity is high. Surface runoff is slow to ponded. The content of organic matter is 5.0 to 7.0 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction is typically neutral or slightly acid in the upper part of the surface layer and neutral below. The subsoil has a medium supply of available phosphorus and a very low supply of available potassium. Tilth is fair. The soil puddles after heavy rains and crusts if tilled when wet.

Most areas are cultivated. Some are permanent pasture. This soil has good potential for cultivated crops and

for hay and pasture if it is drained and protected from floodwater.

In drained areas this soil is suited to corn and soybeans unless flooding is too frequent. It is also suited to grasses and legumes for hay and pasture. The flooding can delay spring plowing and planting. Artificial drainage is needed in some areas to lower the water table and to improve the timeliness of fieldwork. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth. Generally, no applications of lime are needed.

Most areas that are frequently flooded, cut up by old stream channels, or inadequately drained are pastureland or hayland. If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIw.

977—Richwood silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on stream benches adjacent to the major streams and rivers. Individual areas are irregular in shape and range from 5 to 25 acres in size.

Typically, the surface layer is very dark brown and very dark grayish brown silt loam about 19 inches thick. The subsoil is dark yellowish brown, friable silt loam about 29 inches thick. The substratum to a depth of about 68 inches is yellowish brown, friable silt loam.

Permeability is moderate, and available water capacity is high. Surface runoff is slow to medium. The content of organic matter is 3.0 to 4.0 percent in the surface layer. Most of this organic matter is in the plow layer. Reaction varies in the surface layer as a result of local liming practices. The subsoil has a very low supply of available phosphorus and available potassium. Tilth is good.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. In some areas properly located diversion terraces can protect the soil from the deposition of silt from higher lying soils. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability class I.

1119—Muscatine silt loam, benches, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on loess-covered stream benches. Individual areas are irregular in shape and range from 5 to 35 acres in size.

Typically, the surface layer is black silt loam about 8 inches thick. The subsurface layer is black and very dark brown silty clay loam about 10 inches thick. The subsoil is friable silty clay loam about 30 inches thick. The upper part is very dark grayish brown, the next part is dark grayish brown and has yellowish brown mottles, and the lower part is dark grayish brown and grayish brown and has yellowish brown and strong brown mottles. The substratum is light brownish gray, friable silt loam mottled with yellowish brown and strong brown. Stratified sand is below a depth of 5 to 8 feet. In some areas it is as shallow as 4 feet. In places the surface layer is silty clay loam. In some areas the slope is 2 to 5 percent.

Permeability is moderate, and available water capacity is high. Surface runoff is slow. The content of organic matter is 5.0 to 6.0 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. Tilth is good.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It commonly receives runoff from adjacent slopes and has a seasonal high water table. Tile drainage can improve the timeliness of fieldwork. Diversions are needed on some of the soils upslope to prevent excessive runoff and siltation on this soil. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability class I.

1133—Colo silty clay loam, channeled, 0 to 2 percent slopes. This nearly level, poorly drained soil is on flood plains that have been dissected by old stream channels, meandering stream channels, and bayous. It is subject to flooding. Individual areas are long and range from 20 to 50 acres in size.

Typically, the surface layer is black and very dark gray silty clay loam about 43 inches thick. The substratum to a depth of about 60 inches is olive gray, firm silty clay loam mottled with olive brown.

Permeability is moderate, and available water capacity is high. Surface runoff is very slow. The content of organic matter is 5.0 to 7.0 percent in the surface layer. Reaction is typically neutral or slightly acid in the upper part of the surface layer and neutral in the lower part and the substratum. The lower part of the surface layer

has a medium supply of available phosphorus and a very low supply of available potassium. Tilth is fair. The soil puddles readily when wet and is cloddy and hard when dry.

Most areas are pastured. This soil has poor potential for cultivated crops and hay and fair potential for pasture.

This soil is poorly suited to corn and soybeans and to grasses for hay. Many old stream channels, meanders, and bayous interfere with fieldwork. Many of the channels cannot be crossed by farm machinery, and some are filled with water at least part of the year. Only small areas of this soil can be cropped. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass Vw.

1160—Walford silt loam, benches, 0 to 1 percent slopes. This nearly level, poorly drained soil is on loess-covered stream benches. Individual areas are irregular in shape and range from 2 to 15 acres in size.

Typically, the surface layer is very dark gray silt loam about 6 inches thick. The subsurface layer is dark grayish brown and grayish brown silt loam about 9 inches thick. The subsoil is about 44 inches thick. The upper part is grayish brown, friable silt loam mottled with strong brown; the next part is light brownish gray and grayish brown, firm silty clay loam that has strong brown mottles and light gray silt coatings; the lower part is mottled light brownish gray and strong brown, firm silty clay loam. The substratum is mottled light brownish gray and yellowish brown, friable silt loam. Stratified sand is below a depth of 5 to 8 feet. In some areas it is as shallow as 4 feet.

Permeability is moderate, and available water capacity is high. Surface runoff is slow to ponded. The content of organic matter is 2.5 to 3.5 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The subsoil has a very low supply of available phosphorus and available potassium. Tilth is fair. The soil puddles after heavy rains or if worked when wet.

Many areas are cultivated. A few are permanent pasture or wildlife habitat. This soil has fair potential for cultivated crops and for hay, pasture, and trees.

If drained, this soil is suited to corn and soybeans. It is also suited to grasses and legumes for hay and pasture. In some areas water that is ponded for short periods drowns out crops. Open ditches and tile are needed to successfully drain some areas. Most undrained areas are left idle. Other small, isolated areas are left idle in wet years or are used as wildlife habitat. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction, an increased runoff rate, and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Capability subclass IIw.

1220—Nodaway silt loam, channeled, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on flood plains dissected by meandering streams and oxbows. It is subject to flooding. Individual areas are long or irregularly shaped and range from 20 to several hundred acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The substratum to a depth of about 60 inches is dark grayish brown, grayish brown, and brown, friable silt loam.

Included with this soil in mapping are small areas of Arenzville soils. In these soils 20 to 40 inches of recent alluvium overlies a dark colored buried soil.

Permeability is moderate in the Nodaway soil, and available water capacity is high. Surface runoff is slow. The content of organic matter is 2.0 to 3.0 percent in the surface layer. Reaction typically is slightly acid or neutral throughout the profile. The subsoil has a medium supply of available phosphorus and available potassium. Tilth is good.

Most areas are pastured or wooded. This soil has poor potential for cultivated crops and good potential for hay and pasture.

This soil generally is not suited to corn, soybeans, and small grain because the flood hazard is severe and the old stream channels are ponded for long periods. Many of the old stream channels and oxbows are inaccessible to farm machinery. If cultivated crops are grown, land leveling, flood control, and surface drainage are needed in many areas. Generally, no applications of lime are needed.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees. A few small areas remain in native hardwoods. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation or by spraying, cutting, and girdling.

Capability subclass Vw.

1291—Atterberry silt loam, benches, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil

is on loess-covered stream benches. Individual areas are irregular in shape and range from 5 to 25 acres in size.

Typically, the surface layer is very dark brown silt loam about 9 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is friable silty clay loam about 28 inches thick. The upper part is brown, the next part is grayish brown and has yellowish brown and strong brown mottles, and the lower part is mottled light brownish gray, yellowish brown, and strong brown. The substratum is light brownish gray, friable silt loam mottled with yellowish brown, light brownish gray, and strong brown. Stratified sand is below a depth of 5 to 8 feet. In some areas it is as shallow as 4 feet. In places the surface layer is lighter colored.

Included with this soil in mapping are small areas of the poorly drained Walford soils.

Permeability is moderately slow in the Atterberry soil, and available water capacity is high. Surface runoff is slow. The content of organic matter is 2.5 to 3.5 percent in the surface layer. Reaction varies in this layer as a result of local liming practices. The subsoil has a low supply of available phosphorus and a very low supply of available potassium. Tilth is good. The plow layer puddles during intense rains, forming a crust that sometimes retards plant growth.

Most areas are cultivated. This soil has good potential for cultivated crops and for hay, pasture, and trees.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It has a seasonal high water table, especially in spring. Tile drainage can improve the timeliness of fieldwork in years of above normal rainfall. On some of the soils upslope, diversions are needed to prevent excessive runoff and siltation on this soil. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet results in surface compaction and poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Tree seeds, cuttings, and seedlings can survive and grow well if competing vegetation is controlled or removed.

Capability class I.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, for woodland, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities, and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

Haskell H. Bright, Jr., district conservationist, Soil Conservation Service, prepared this section.

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the man-

agement practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

About 352,867 acres in the survey area was used for agricultural purposes in 1974, according to the Iowa Annual Farm Census. Of this total, approximately 54,410 acres was used for pasture; 217,463 acres for row crops, mainly corn and beans; 18,411 acres for close-grown crops, mainly oats and wheat; 24,577 acres for hay; and 38,145 acres for other purposes.

Food production could be increased by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology.

More land is being used each year for urban development. Good land use should be based upon the properties and capabilities of soils. The use of this soil survey to help make land-use decisions that will influence the future role of farming in the county is described under the heading "General soil map for broad land-use planning."

Soil erosion is the major soil problem on about two-thirds of the cropland and pasture in Cedar County. If the slope is more than 1 percent, erosion is a hazard.

Loss of the surface layer through erosion is damaging for many reasons. Productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is damaging to soils that are shallow over bedrock because it restricts the root zone. Erosion also reduces productivity on soils that tend to be droughty, such as Chelsea, Dickinson, and Lamont soils. Loss of the surface layer can result in the pollution of streams by sediment. Erosion control keeps this pollution to a minimum and improves water quality for municipal use, for recreation, and for fish and wildlife.

Erosion-control practices provide protective surface cover, reduce the runoff rate, and increase the infiltration rate. A cropping system that keeps a plant cover on the soil for extended periods can hold soil erosion losses to an amount that will not reduce the productive capacity of the soils. On livestock farms, which require pasture and hay, including legume and grass forage crops in the cropping system not only provides nitrogen and improves tilth for the following crop but also reduces the risk of erosion on sloping soils.

Many slopes are so short, steep, and irregular that contour tillage or terraces are not practical. Examples are some areas of Downs and Fayette soils. On these soils minimum tillage and a cropping system that provides substantial plant cover are needed to control erosion.

Minimizing tillage and leaving crop residue on the surface help to increase the infiltration rate and reduce the hazards of runoff and erosion. They can be adapted to all tillable soils in the survey area. No tillage for corn and soybeans, which is becoming more popular, is the most effective erosion control practice on soils that are cropped year after year.

Terraces and diversions reduce the length of slopes and the hazards of runoff and erosion. They are most practical on well drained, gently sloping or moderately sloping soils that have regular slopes. The gently sloping Downs and Tama soils are very well suited to terracing. Soils that have a glacial till subsoil can be terraced, but the cuts should not expose the glacial till. Topsoil from Bassett, Dinsdale, Kenyon, and Waubeek soils can be used to cover the less fertile glacial till.

Contouring and, less commonly, contour stripcropping are effective in controlling erosion in the survey area. They are best suited to soils with smooth, uniform slopes, such as Downs and Tama soils and some areas of Fayette soils.

Soil blowing is a hazard on the sandy Chelsea and Sparta soils (fig. 14). It can damage these soils in a few hours if winds are strong and the soils are dry and have no plant cover or surface mulch. Maintaining plant cover or surface mulch and keeping the surface rough through proper tillage minimize the risk of soil blowing.

Figure 14.—Soil blowing on Sparta loamy fine sand.

Information about the design of erosion-control practices for each kind of soil is contained in the Technical

Guide, available in local offices of the Soil Conservation Service.

Soil drainage is a problem in managing some soils. Some soils are naturally wet and poorly drained. Examples are the Ansgar, Garwin, Maxfield, Sperry, and Walford soils in the uplands. Other soils are poorly drained because they are in waterways or on bottom land. Colo and Sawmill soils are examples. All of these soils are more productive after they are tiled, but tiling is not effective in some areas of Ansgar, Sperry, and Walford soils.

Soil fertility is naturally low in most of the soils on the uplands in the survey area. Most of these soils are naturally acid. The soils on flood plains, such as Arenzville, Colo, Sawmill, and Spillville soils, are slightly acid to mildly alkaline.

The Downs and Fayette soils in the uplands are naturally acid. Unless these soils are limed, applications of ground limestone are needed to raise the pH level sufficiently for good growth of alfalfa and other crops that grow well only on nearly neutral soils. The supply of available potash is naturally very low in Downs, Fayette, and Tama soils and in most of the other upland soils. The supply of available phosphorus is high in the subsoil of such timbered soils as Fayette soils, medium in the subsoil of Downs soils, and low in the subsoil of Tama soils. On all soils additions of lime and fertilizer should be based on results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the appropriate kinds and amounts of fertilizer and lime.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous and generally high in content of organic matter.

Most of the soils that are cropped in the survey area have a silt loam surface layer. Some soils, such as Fayette, have a low content of organic matter, and intense rainfall causes the formation of a crust on the surface. The crust is hard when dry and hinders water infiltration. Once the crust forms and reduces the infiltration rate, the runoff rate increases significantly. Regular additions of crop residue, manure, and other organic material improve soil structure and reduce the liklihood of crust formation.

Fall plowing is not suitable on light colored forest soils because a crust forms during winter and spring. Many of the soils are nearly as dense and hard at the time of planting as they were before fall plowing. Also, most cropland consists of sloping soils that are subject to damaging erosion if they are fall plowed.

Field crops suited to the soils and climate of the survey area include many that are not commonly grown. Corn and soybeans are by far the most common crops grown. Grain sorghum, sunflowers, potatoes, sugar beets, sweet corn, popcorn, pumpkins, sugar cane, canning peas, canning beans, and navy beans can be grown. Oats is the most common close-growing crop. Rye, barley, buckwheat, wheat, and flax could be grown, and grass seed could be produced from bromegrass, redtop, bluegrass, switchgrass, big bluestem, and indiangrass.

Specialty crops that are grown commercially in the survey area are limited in extent. Tomatoes and apples are the only specialty crops. Most of the well drained soils in the survey area are suitable for orchards and nursery plants. Soils in low positions where frost is frequent and air drainage is poor, however, generally are poorly suited to early vegetables, small fruit, and orchards.

The latest information about growing specialty crops can be obtained from local offices of the Cooperative Extension Sevice and the Soil Conservation Service.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 5.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

The estimated yields reflect the productive capacity of the soils for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit (*15*). The capability class and subclass are defined in the following paragraphs. A survey area may not have soils of all classes.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Capability subclasses are soil groups within one class; they are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability subclass is identified in the description of each soil map unit in the section "Soil maps for detailed planning."

Woodland management and productivity

Table 6 contains information useful to woodland owners or forest managers planning use of soils for wood crops. Map unit symbols for soils suitable for wood crops are listed, and the ordination (woodland suitability) symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates insignificant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the following order: x, w, t, d, c, s, f, and r.

In table 6 the soils are also rated for a number of factors to be considered in management. *Slight, moderate,* and *severe* are used to indicate the degree of major soil limitations.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if some measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal

limitation or a need for some modification in management or equipment; *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree that the soil affects expected mortality of planted tree seedlings. Plant competition is not considered in the ratings. Seedlings from good planting stock that are properly planted during a period of sufficient rainfall are rated. A rating of *slight* indicates that the expected mortality of the planted seedlings is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade or grow if openings are made in the tree canopy. The invading plants compete with native plants or planted seedlings by impeding or preventing their growth. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* means that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed for the control of undesirable plants.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Important trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suitable for commercial wood production and that are suited to the soils.

Windbreaks and environmental plantings

Windbreaks are established to protect livestock, buildings, and yards from wind and snow. Windbreaks also help protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broad-leaved and coniferous species provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field, the interval depending on erodibility of the soil. They protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. A healthy planting stock of suitable species planted properly on a well prepared site and maintained in good condition can insure a high degree of plant survival.

Table 7 shows the height that locally grown trees and shrubs are expected to reach on various kinds of soil in 20 years. The estimates in table 7, based on measurements and observation of established plantings that have been given adequate care, can be used as a guide in planning windbreaks and screens. Additional information about planning windbreaks and screens and the planting and care of trees can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from nurserymen.

Engineering

Volney H. Smith, assistant state conservation engineer, Soil Conservation Service, helped prepare this section.

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads,

streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 8 shows, for each kind of soil, the degree and kind of limitations for building site development; table 9, for sanitary facilities. Table 11 shows the kind of limitations for water management. Table 10 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 8. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 8 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 8 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 9 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which, respectively, mean about the same as the terms *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system (fig. 15).

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not

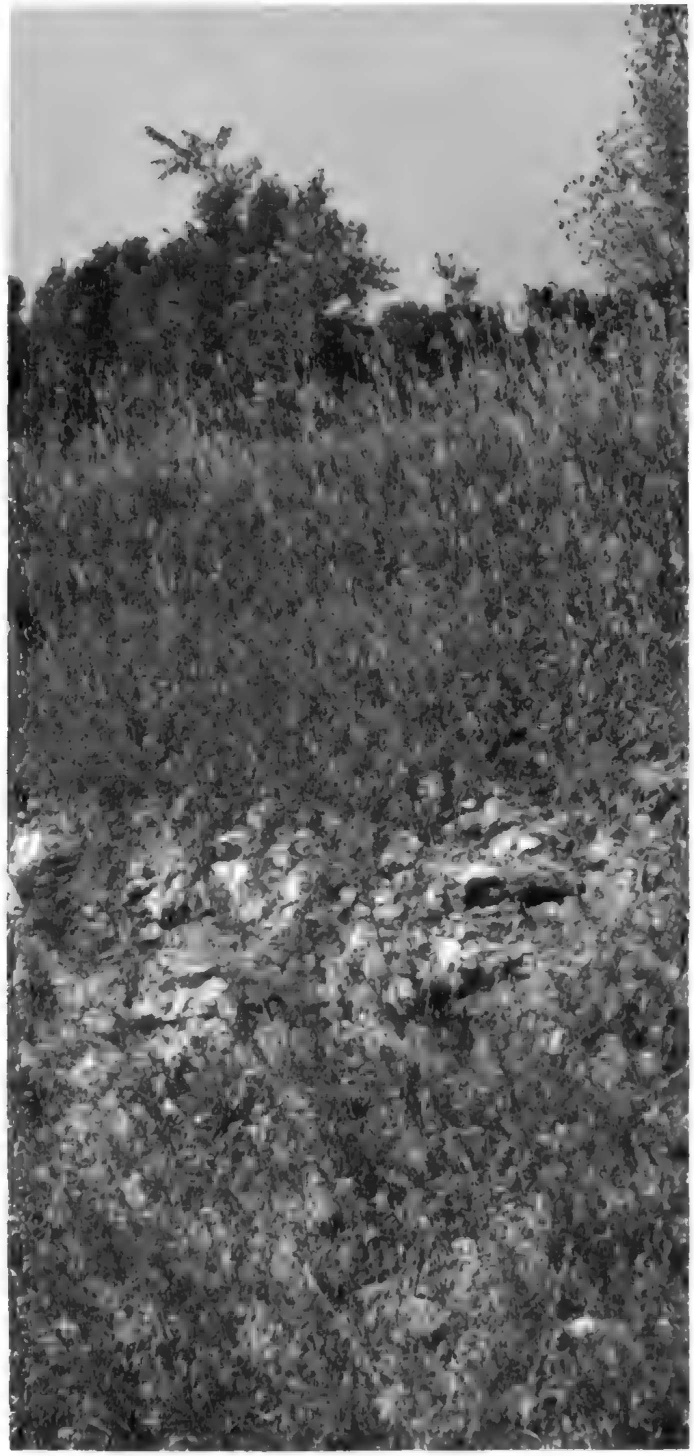


Figure 15.—Fractured limestone close to the surface. The soil is poor filtering material for purifying effluent.

suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 9 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 10 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 14 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 10 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 14.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in

preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 11 the soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water-control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

The soils of the survey area are rated in table 12 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 12 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields,

given in table 9, and interpretations for dwellings without basements and for local roads and streets, given in table 8.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They have moderate slopes and have few or no stones or boulders on the surface.

Wildlife habitat

Bill D. Welker, biologist, Soil Conservation Service, helped prepare this section.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 13, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, orchardgrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Hardwood trees and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat.

Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of native plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, and elderberry. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, and cordgrass and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail rabbit, and red fox.

Woodland habitat consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features.

Engineering properties

Table 14 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 14 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 14 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The estimated classification, without group index numbers, is given in table 14. Also in table 14 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Ranges in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterburg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 15 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible, but crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible, and crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 16 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding is the temporary covering of soil with water from overflowing streams and runoff from adjacent slopes. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Potential frost action refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*14*). Unless otherwise noted, colors described are for moist soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

Ansgar series

The Ansgar series consists of poorly drained, moderately permeable soils that formed in 24 to 48 inches of loess and in the underlying glacial till. These soils are in flat or depressional areas on upland divides or in shallow drainageways. Slope ranges from 0 to 2 percent.

Most of the Ansgar soils in this county formed in a thicker layer of loess than is defined as the range for the Ansgar series. This difference, however, does not alter the use or behavior of the soils.

Ansgar soils are similar to Dinsdale soils and are commonly adjacent to Klinger, Franklin, and Maxfield soils on the landscape. Dinsdale, Franklin, and Klinger soils are better drained than Ansgar soils. Also, Dinsdale soils have a browner B horizon and Klinger soils do not have an A2 horizon. Maxfield soils have a thicker dark colored A horizon than Ansgar soils and have no A2 horizon.

Typical pedon of Ansgar silt loam, 0 to 2 percent slopes, 760 feet east and 820 feet south of the northwest corner of sec. 33, T. 81 N., R. 3 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silt loam; weak fine granular structure; friable; neutral; abrupt boundary.

A2—8 to 19 inches; grayish brown (10YR 5/2) silt loam; few fine faint dark yellowish brown (10YR 3/4 and 4/4) mottles; weak fine platy structure; friable; medium acid; clear boundary.

B1—19 to 25 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; strongly acid; clear boundary.

B21t—25 to 32 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; few thin discontinuous clay films on faces of peds; thin discontinuous light gray (10YR 7/1, dry) silt coatings on faces of peds; strongly acid; gradual boundary.

B22t—32 to 40 inches; gray (5Y 5/1) heavy silty clay loam; common fine prominent dark brown (7.5YR 4/4) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few thin discontinuous clay films; strongly acid; gradual boundary.

IIB31t—40 to 47 inches; mottled grayish brown (2.5Y 5/2) and strong brown (7.5YR 5/6) heavy loam; moderate medium prismatic structure; firm; medium acid; clear boundary.

IIB32t—47 to 60 inches; mottled yellowish brown (10YR 5/6) and light brownish gray (2.5Y 6/2) sandy clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure; firm; medium acid.

The solum typically is more than 48 inches thick but ranges from 40 to 80 inches. It formed partly in loess and partly in glacial till. The loess is typically 24 to 40 inches thick but ranges to 48 inches.

The Ap horizon is very dark gray (10YR 3/1) or black (10YR 2/1). It is 6 to 9 inches thick. The A2 horizon typically has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is 4 to 12 inches thick.

The upper part of the B horizon has hue of 2.5Y, 10YR, or 5Y; value of 4 or 5; and chroma of 1 or 2. Mottles have a higher chroma and can have hue of 7.5YR. This part of the B horizon ranges from light silty clay loam to heavy silty clay loam. It can average as low as 27 percent clay in one pedon and as high as 35 percent in another. In most places a stone line or a thin lens of sandy material at a depth of 24 to 48 inches separates the silty upper part of the B horizon from the loamy lower part.

The IIB horizon has hue of 2.5Y, 10YR, or 5Y; value of 5 or 6; and chroma of 1 or 2. Mottles have a higher chroma and can have hue of 7.5YR. This part of the B horizon typically is heavy loam and sandy clay loam but can be clay loam. It is medium acid or slightly acid.

A C horizon is within a depth of 60 inches in some pedons. It is mottled yellowish brown and light brownish gray, firm heavy loam.

Arenzville series

The Arenzville series consists of moderately well drained, moderately permeable soils that formed in silty alluvium 20 to 40 inches deep over an older buried soil. These soils are on flood plains and in upland drainageways. Slope ranges from 0 to 2 percent.

Arenzville soils are similar to Radford soils and are commonly adjacent to Colo and Nodaway soils on the landscape. Colo soils are dark colored and are not covered with more than 20 inches of overwash in all areas. Nodaway soils do not have a buried soil within 3 feet of the surface. Radford soils have a darker colored surface layer than Arenzville soils.

Typical pedon of Arenzville silt loam, 0 to 2 percent slopes, 940 feet west and 1,000 feet north of the southeast corner of sec. 3, T. 80 N., R. 4 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; friable; neutral; clear boundary.

C1—6 to 28 inches; dark grayish brown (10YR 4/2) and brown (10YR 4/3) silt loam; weak medium platy structure; friable; thin very dark grayish brown (10YR 3/2) and brown (10YR 5/3) silt strata; medium acid; abrupt boundary.

Ab—28 to 40 inches; black (N 2/0) heavy silt loam; weak medium platy structure parting to weak fine granular; friable; slightly acid; clear boundary.

C2—40 to 60 inches; very dark gray (10YR 3/1 and 5Y 3/1) and dark gray (10YR 4/1) silty clay loam; weak medium prismatic structure parting to moderate medium subangular blocky; friable; neutral.

Depth to the Ab horizon ranges from 20 to 40 inches. The Ap and C1 horizons range dominantly from dark grayish brown (10YR 4/2) to light brownish gray (10YR 6/2). Some strata have value of 3 to 6 and chroma of 1 to 3. In some pedons thin strata of sand are dispersed throughout the silt loam in the Ap and C1 horizons. The buried soil is silty clay loam or silt loam.

Atterberry series

The Atterberry series consists of somewhat poorly drained, moderately or moderately slowly permeable soils that formed in more than 40 inches of loess. These soils are on upland divides, at the head of drainageways, at the base of slopes, and on loess-covered benches along the major streams. Slope ranges from 0 to 5 percent.

Atterberry soils are similar to Downs soils and are commonly adjacent to Downs, Muscatine, Tama, and Walford soils. Downs and Tama soils have a browner B horizon than Atterberry soils and are better drained. Muscatine soils have a thicker dark colored A horizon than Atterberry soils. Walford soils are more poorly drained than Atterberry soils and generally are lower on the landscape.

Typical pedon of Atterberry silt loam, 0 to 2 percent slopes, 640 feet east and 240 feet north of the southwest corner of SE1/4 sec. 22, T. 80 N., R. 1 W.

Ap—0 to 9 inches; very dark brown (10YR 2/2) silt loam; weak fine subangular blocky structure; friable; neutral; abrupt boundary.

A2—9 to 16 inches; dark grayish brown (10YR 4/2) silt loam; weak fine platy structure; friable; slightly acid; clear boundary.

B1—16 to 20 inches; brown (10YR 5/3) silty clay loam; few fine faint yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; friable; medium acid; gradual boundary.

B21t—20 to 28 inches; grayish brown (10YR 5/2) silty clay loam; common fine faint yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; moderate fine and medium subangular blocky structure; friable; light gray (10YR 7/2, dry) continuous silt coatings between depths of 24 and 28 inches; few thin discontinuous clay films on faces of peds; medium acid; gradual boundary.

B22t—28 to 36 inches; grayish brown (2.5Y 5/2) silty clay loam; many medium distinct strong brown (7.5YR 5/6 and 5/8) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; thin discontinuous clay films on faces of peds; strongly acid; gradual boundary.

B3—36 to 48 inches; mottled light brownish gray (2.5Y 6/2), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6) silty clay loam; weak medium prismatic structure; friable; medium acid; gradual boundary.

C1—48 to 58 inches; mottled light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/6) silt loam; massive; friable; slightly acid; gradual boundary.

C2—58 to 62 inches; light brownish gray (2.5Y 6/2) silt loam; many coarse distinct strong brown (7.5YR 5/6) mottles; massive; friable; slightly acid.

The solum ranges from 40 to 60 inches or more in thickness. The A1 or Ap horizon ranges from 6 to 10 inches in thickness. It is very dark gray (10YR 3/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). The A2 horizon is 3 to 8 inches thick. The B2 horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. It can average as low as 29 percent in one pedon and as high as 35 percent in another. It is medium acid or strongly acid. The B3 horizon generally has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2, but some mottles have a higher chroma.

Bassett series

The Bassett series consists of moderately well drained, moderately permeable soils on uplands. These soils formed in 14 to 26 inches of loamy material and in the underlying glacial till. They are on ridgetops and side slopes. Slope ranges from 2 to 14 percent.

Bassett soils are similar to Kenyon soils and are commonly adjacent to Dinsdale, Kenyon, and Waubeek soils. Dinsdale and Waubeek soils formed in loess and glacial till. Kenyon soils have a thicker, darker A horizon than Bassett soils.

Typical pedon of Bassett loam, 2 to 5 percent slopes, 340 feet west and 720 feet south of the northeast corner of sec. 2, T. 82 N., R. 2 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam; granular structure; friable; neutral; abrupt boundary.

B1t—8 to 18 inches; yellowish brown (10YR 5/6) loam; dark yellowish brown (10YR 4/4) coatings on faces of peds; weak medium prismatic structure parting to weak fine subangular blocky; friable; few discontinuous clay films on faces of peds; few 2-millimeter stones between depths of 16 and 18 inches; medium acid; gradual boundary.

IIB21t—18 to 24 inches; yellowish brown (10YR 5/6) heavy loam; dark yellowish brown (10YR 4/4) coatings on faces of peds; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; light gray (10YR 7/2, dry) silt and sand coatings on faces of peds; discontinuous clay films on faces of peds; strongly acid; gradual boundary.

IIB22—24 to 31 inches; yellowish brown (10YR 5/6) heavy loam; yellowish brown (10YR 5/4) coatings on faces of peds; moderate medium prismatic structure; firm; thick light gray (10YR 7/2, dry) silt and sand coatings on faces of peds; strongly acid; gradual boundary.

IIB3—31 to 46 inches; yellowish brown (10YR 5/6) heavy loam; yellowish brown (10YR 5/4) coatings on faces of peds; few fine faint grayish brown (10YR 5/2) mottles; moderate coarse prismatic structure; firm; thick light gray (10YR 7/2, dry) silt and sand coatings on faces of peds; strongly acid; gradual boundary.

IIC—46 to 66 inches; yellowish brown (10YR 5/6) heavy loam; many medium faint grayish brown (10YR 5/2) mottles; massive; firm; few fine dark reddish brown (5YR 3/2) concretions; medium acid.

The solum ranges from 40 to 60 inches in thickness. The depth to glacial till ranges from about 14 to 26 inches in uneroded areas.

In uncultivated areas the A1 horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2) and is 6 to 9 inches thick. An A2 horizon is in some pedons. It is brown (10YR 4/3 or 5/3) and is 4 to 6 inches thick. In places it is incorporated into the Ap horizon.

The upper part of the B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or higher, and it lacks distinct lower chroma mottles. The depth to low chroma mottles ranges from 24 to about 34 inches. The IIB horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or higher. Mottles have a lower chroma. The finest texture in the B horizon is typically loam, but in

places it is clay loam or sandy clay loam. This horizon ranges from medium acid to very strongly acid.

Brady series

The Brady series consists of somewhat poorly drained soils that are moderately rapidly permeable in the upper part and very rapidly permeable in the lower part. These soils formed in loamy alluvial deposits over sand. They are on stream benches and in upland drainageways that lack well defined outlets. Slope ranges from 0 to 2 percent.

The Brady soils in this survey area are outside the limits defined for the Brady series. The solum contains very little gravel, and the soil colors differ. Also, the soils are not saturated for long enough periods to qualify as Aqualfs. These differences, however, do not alter the use or behavior of the soils.

Brady soils are similar to Dickinson soils and are commonly adjacent to Chelsea, Dickinson, Saude, and Sparta soils on the landscape. Chelsea soils are excessively drained and contain more sand in the upper part of the solum than Brady soils. Dickinson soils are well drained or somewhat excessively drained and have a browner B horizon than Brady soils. Saude soils are well drained and also have a browner B horizon. They have loam in the upper part of the solum. Sparta soils are excessively drained and contain more sand than Brady soils.

Typical pedon of Brady sandy loam, 0 to 2 percent slopes, 280 feet west and 1,200 feet north of the center of sec. 31, T. 79 N., R. 2 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) sandy loam; weak fine granular structure; friable; neutral; abrupt boundary.

A2—9 to 13 inches; dark grayish brown (10YR 4/2) sandy loam; few fine faint yellowish brown (10YR 5/4) mottles; weak medium platy structure; friable; neutral; clear boundary.

B1—13 to 20 inches; grayish brown (10YR 5/2) loam; many fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; slightly acid; gradual boundary.

B2t—20 to 33 inches; mottled yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) sandy loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; few thin patchy clay films on faces of peds; slightly acid; abrupt boundary.

B3t—33 to 38 inches; mottled grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) sandy loam; weak medium subangular blocky structure; very friable; clay bridging between sand grains; strongly acid; clear boundary.

IIC—38 to 60 inches; pale brown (10YR 6/3) fine sand and sand; common medium distinct dark brown (7.5YR 4/4) mottles; single grain; loose; neutral.

The solum ranges from about 20 to 40 inches in thickness. The A1 or Ap horizon ranges from 6 to 10 inches in thickness. It has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 2. In some pedons it does not have yellowish brown mottles. It is 3 to 7 inches thick.

The B horizon has hue of 10YR, 7.5YR, or 2.5Y; value of 4 to 6; and chroma of 2 to 6. It has high and low chroma mottles. It is sandy loam, loam, or sandy clay loam. It ranges from slightly acid to strongly acid.

The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6. It is dominantly fine sand and sand, but it has some coarse sand and very little gravel in some pedons.

Chelsea series

The Chelsea series consists of excessively drained, rapidly permeable soils that formed dominantly in sand deposited by wind. These soils dominantly are on ridges and side slopes in the uplands, but in a few areas they are on stream benches. Slope ranges from 2 to 20 percent.

Chelsea soils are similar to Sparta soils and are commonly adjacent to Dickinson, Fayette, Lamont, and Sparta soils on the landscape. Dickinson and Lamont soils contain less sand in the upper part of the solum than Chelsea soils. Also, Dickinson soils have a thicker dark colored A1 horizon. Fayette soils formed in loess and are silty. Sparta soils have a thicker dark colored A1 horizon than Chelsea soils and lack an A2 horizon.

Typical pedon of Chelsea loamy fine sand, 5 to 9 percent slopes, 740 feet north and 200 feet west of the center of SW1/4 sec. 19, T. 79 N., R. 2 W.

A11—0 to 2 inches; very dark gray (10YR 3/1) loamy fine sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; much decomposed leaf litter and many fine roots; medium acid; abrupt boundary.

A12—2 to 5 inches; very dark grayish brown (10YR 3/2) loamy fine sand, grayish brown (10YR 5/2) dry; single grain; loose; medium acid; clear boundary.

A21—5 to 11 inches; dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) fine sand; single grain; loose; strongly acid; gradual boundary.

A22—11 to 17 inches; dark brown (10YR 4/3) fine sand; single grain; loose; strongly acid; gradual boundary.

A23—17 to 48 inches; yellowish brown (10YR 5/4) fine sand; single grain; loose; strongly acid; gradual boundary.

A&B—48 to 62 inches; yellowish brown (10YR 5/4) fine sand; single grain; loose; 1-inch brown (7.5YR 4/4) sandy loam bands at depths of 48, 52, 56, and 60 inches; strongly acid.

The solum ranges from 4 feet to many feet in thickness. In uncultivated areas reaction is strongly acid or medium acid in the surface layer and the subsurface layer.

In uncultivated areas the A1 horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2) and is 3 to 5 inches thick. The Ap horizon is dark grayish brown (10YR 4/2), dark brown (10YR 3/3), or brown (10YR 4/3). The A horizon ranges from loamy fine sand to fine sand.

The A&B horizon has lamellae that are 1/4 inch to 2 inches thick and have hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 3 or 4. Depth to the uppermost lamella ranges from 3 1/2 to 4 1/2 feet.

Colo series

The Colo series consists of poorly drained, moderately permeable soils that formed in moderately fine textured alluvial deposits. These soils are on flood plains and in upland drainageways. Slope ranges from 0 to 2 percent.

Colo soils are similar to Sawmill soils and are commonly adjacent to Kennebec and Radford soils. Kennebec soils contain less clay than Colo soils and are better drained. Radford soils have 20 to 40 inches of overwash. Sawmill soils have a thinner dark colored A horizon than Colo soils.

Typical pedon of Colo silty clay loam, 0 to 2 percent slopes, 880 feet west and 100 feet north of the southeast corner of sec. 36, T. 82 N., R. 3 W.

A11—0 to 8 inches; black (10YR 2/1) silty clay loam; moderate fine granular structure; friable; neutral; gradual boundary.

A12—8 to 25 inches; black (10YR 2/1) silty clay loam; weak medium and fine granular structure; friable; neutral; gradual boundary.

A13—25 to 33 inches; black (10YR 2/1) silty clay loam; weak fine subangular blocky structure; firm; neutral; gradual boundary.

AC—33 to 43 inches; very dark gray (10YR 3/1) silty clay loam; weak fine prismatic structure parting to moderate fine angular blocky; firm; neutral; clear boundary.

Cg—43 to 60 inches; olive gray (5Y 5/2) silty clay loam; common fine distinct olive brown (2.5Y 4/4) mottles; weak coarse prismatic structure; firm; many very dark gray krotovina fillings; few dark reddish brown (5YR 3/2) concretions; neutral.

The solum ranges from 36 to about 50 inches in thickness. Reaction is slightly acid to neutral throughout the profile.

The A horizon is black or very dark gray; it has hue of N or 10YR, value of 2 or 3, and chroma of 0 or 1. The upper 10 inches of this horizon ranges to heavy silt loam. Below a depth of 10 inches, the clay content is commonly 30 to 35 percent, but in thin layers it is as much as 38 percent. Colors that have value of 2 or 3 extend to a depth of 36 inches or more.

The C horizon has hue of 2.5Y or 5Y, value of 3 to 5, and chroma of 1 or 2. It has few to common high chroma mottles in some pedons. In places sandy or gravelly horizons are below a depth of 48 inches.

Dickinson series

The Dickinson series consists of well drained or somewhat excessively drained soils that are moderately rapidly permeable in the upper part and rapidly permeable in the lower part. These soils are on upland ridges and side slopes and on stream benches. Slope ranges from 1 to 9 percent.

Dickinson soils are similar to Lamont soils and commonly are adjacent to Kenyon, Lamont, and Sparta soils on the landscape. Kenyon soils formed in glacial till and contain more clay in the solum than Dickinson soils. Lamont soils have a thinner dark colored A horizon than Dickinson soils. Sparta soils contain more sand in the A horizon and the upper part of the B horizon than Dickinson soils.

Typical pedon of Dickinson fine sandy loam, 1 to 5 percent slopes, 800 feet south and 1,200 feet east of the northwest corner of sec. 22, T. 81 N., R. 4 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) fine sandy loam; weak fine granular structure; very friable; neutral; abrupt boundary.

A12—7 to 14 inches; mixed very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2) fine sandy loam; weak fine granular structure; very friable; slightly acid; gradual boundary.

A3—14 to 18 inches; mixed very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) fine sandy loam; weak medium subangular blocky structure; very friable; slightly acid; gradual boundary.

B21—18 to 26 inches; dark brown (10YR 4/3) fine sandy loam; weak coarse prismatic structure parting to weak fine subangular blocky; very friable; slightly acid; clear boundary.

B22—26 to 33 inches; dark brown (7.5YR 4/4) fine sandy loam; weak coarse prismatic structure; very friable; slightly acid; clear boundary.

B3—33 to 40 inches; strong brown (7.5YR 5/6) loamy sand; weak coarse prismatic structure; very friable; slightly acid; clear boundary.

C—40 to 60 inches; yellowish brown (10YR 5/6) sand; single grain; loose; slightly acid.

The solum ranges from 24 to 40 inches in thickness. Depth to loamy sand or sand is commonly 24 to 36 inches. The sand particles are dominantly fine and medium in size.

The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), very dark grayish brown (10YR 3/2), or dark brown (10YR 3/3). It ranges from 10 to 20 inches in thickness. The B2 horizon is dark brown (10YR 3/3 or 4/3 and 7.5YR 4/4) in the upper part and dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6) in the lower part. It ranges from slightly acid to strongly acid. The C horizon ranges from loamy sand to fine sand and sand.

Dinsdale series

The Dinsdale series consists of moderately well drained and well drained, moderately permeable soils that formed in 24 to 40 inches of loess and in the underlying glacial till. These soils are on ridgetops and side slopes. Slope ranges from 2 to 9 percent.

Dinsdale soils are commonly adjacent to Kenyon, Klinger, and Waubeek soils on the landscape. Kenyon soils contain more sand in the upper part of the profile than Dinsdale soils and are shallower to glacial till. Klinger soils have a grayer B horizon than Dinsdale soils and are somewhat poorly drained. Waubeek soils have a thinner dark colored A horizon than Dinsdale soils.

Typical pedon of Dinsdale silt loam, 2 to 5 percent slopes, 580 feet east and 220 feet south of the northwest corner of NE1/4 sec 7, T. 82 N., R. 2 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam; weak fine granular structure; friable; slightly acid; clear boundary.

A12—8 to 11 inches; very dark grayish brown (10YR 3/2) silt loam; weak fine granular and weak fine subangular blocky structure; friable; slightly acid; gradual boundary.

A3—11 to 15 inches; very dark grayish brown (10YR 3/2) light silty clay loam, dark brown (10YR 3/3) crushed; weak fine subangular blocky structure; friable; medium acid; gradual boundary.

B1—15 to 20 inches; dark brown (10YR 3/3) light silty clay loam, dark brown (10YR 4/3) crushed; moderate fine subangular blocky structure; friable; medium acid; gradual boundary.

B2t—20 to 29 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; friable; few thin discontinuous clay films; medium acid; clear boundary.

IIB31t—29 to 36 inches; yellowish brown (10YR 5/6) heavy loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; few thin discontinuous clay films on faces of peds; discontinuous light gray (10YR 7/2, dry) sand coatings on faces of peds; discontinuous band of pebbles at a depth of 29 to 30 inches; medium acid; gradual boundary.

IIB32t—36 to 60 inches; yellowish brown (10YR 5/8) heavy loam; few medium distinct light brownish gray (2.5Y 6/2) mottles; weak medium prismatic structure; firm; numerous dark reddish brown (5YR 3/2) concretions; medium acid; gradual boundary.

IIC—60 to 70 inches; yellowish brown (10YR 5/8) heavy loam; few medium distinct light brownish gray (2.5Y 6/2) mottles; massive; firm; mildly alkaline.

The solum ranges from 42 to 60 inches in thickness. The loess is 24 to 40 inches thick.

The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). It ranges from 10 to 20 inches in thickness in uneroded areas.

The upper part of the B horizon is dark brown (10YR 3/3), brown (10YR 4/3), or dark yellowish brown (10YR 4/4). It is medium acid or strongly acid. The clay content ranges from about 29 to 34 percent. In places a layer of sandy loam or loamy sand as much as 10 inches thick is between the loess and the glacial till.

The lower part of the B horizon and the C horizon have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. They have few to common mottles that have value of 4 to 6 and chroma of 1 to 6. These horizons typically are loam but range to sandy clay loam and clay loam. Carbonates are at a depth of about 45 to 65 inches.

Dinsdale silt loam, 5 to 9 percent slopes, moderately eroded, is outside the range of the Dinsdale series because the A horizon does not qualify as a mollic epipedon. This difference, however, does not alter the use or behavior of the soil.

Downs series

The Downs series consists of well drained, moderately permeable soils that formed in loess more than 40 inches thick. These soils are on upland ridges and side slopes and on stream benches. Slope ranges from 2 to 14 percent.

Downs soils are similar to Fayette soils and are commonly adjacent to Fayette and Tama soils on the landscape. Fayette soils have a thinner dark colored A horizon than Downs soils and a more distinct A2 horizon. Tama soils have a thicker dark colored A1 horizon and lack an A2 horizon.

Typical pedon of Downs silt loam, 2 to 5 percent slopes, 1,020 feet north and 355 feet east of the southwest corner of sec. 6, T. 79 N., R. 3 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silt loam; weak fine granular structure; friable; slightly acid; abrupt boundary.

A2—8 to 11 inches; dark grayish brown (10YR 4/2) silt loam; weak fine platy structure; friable; light gray (10YR 7/2, dry) silt coatings on faces of peds; slightly acid; clear boundary.

B1—11 to 17 inches; dark brown (10YR 4/3) heavy silt loam; dark brown (10YR 3/3) coatings on faces of peds; moderate fine subangular blocky structure; friable; thin discontinuous light gray (10YR 7/2, dry) silt coatings on faces of peds; medium acid; clear boundary.

B21t—17 to 25 inches; dark yellowish brown (10YR 4/4) light silty clay loam; dark brown (10YR 4/3) coatings on faces of peds; moderate fine subangular blocky structure; friable; thin discontinuous clay films on faces of peds; thin discontinuous light gray (10YR 7/2, dry) silt coatings on faces of peds; medium acid; clear boundary.

B22t—25 to 39 inches; yellowish brown (10YR 5/4) silty clay loam; moderate fine and medium subangular blocky structure; friable; thick continuous light gray (10YR 7/2, dry) silt coatings on faces of peds; few dark reddish brown (5YR 3/2) oxides in the lower part; thin discontinuous clay films on faces of peds; strongly acid; gradual boundary.

B3t—39 to 49 inches; mottled light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) light silty clay loam; weak coarse prismatic structure; friable; thin discontinuous very dark grayish brown (10YR 3/2) clay films on faces of peds; few dark reddish brown (5YR 3/2) oxides; strongly acid; gradual boundary.

C1—49 to 60 inches; mottled light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) heavy silt loam; massive; friable; medium acid; gradual boundary.

C2—60 to 71 inches; mottled light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) silt loam; massive; few dark reddish brown (5YR 3/2) oxides; friable; medium acid.

The solum ranges from 48 to 70 inches in thickness. The A1 horizon, if it occurs, is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It ranges from 6 to 10 inches in thickness. The A2 horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3). It is 2 to 4 inches thick. In places it is incorporated wholly into the Ap horizon. The upper part of the B horizon is dark brown (10YR 3/3) or brown (10YR 4/3) and grades to value of 4 or 5 and chroma of 4 to 6 with increasing depth.

The finest textured part of the B horizon is silty clay loam, and the clay content ranges from 27 to 35 percent. The depth to low chroma mottles typically is more than 35 inches. The B horizon ranges from medium acid to very strongly acid.

Ely series

The Ely series consists of somewhat poorly drained, moderately permeable soils that formed in sediment washed from loess-covered adjacent hillsides. These soils are on foot slopes and on fans where waterways empty onto bottom land. Slope ranges from 2 to 5 percent.

Ely soils are similar to Judson soils and are commonly adjacent to Colo, Judson, and Tama soils. Colo soils are poorly drained and have a thicker A horizon than Ely soils. Judson soils have a browner B horizon than Ely soils and are better drained. Tama soils also are better drained and are higher on the landscape.

Typical pedon of Ely silt loam, 2 to 5 percent slopes, 2,240 feet north and 140 feet east of the southwest corner of sec. 15, T. 81 N., R. 3 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam; weak fine granular structure; friable; neutral; abrupt boundary.

A12—8 to 16 inches; black (10YR 2/1) silty clay loam, very dark brown (10YR 2/2) crushed; weak fine granular structure; friable; neutral; gradual boundary.

A3—16 to 25 inches; very dark grayish brown (10YR 3/2) silty clay loam; very dark gray (10YR 3/1) coatings on faces of peds; weak fine subangular blocky structure parting to weak fine granular; friable; medium acid; gradual boundary.

B1—25 to 33 inches; dark grayish brown (10YR 4/2) silty clay loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; few fine distinct dark brown (7.5YR 4/4) mottles; moderate fine subangular blocky structure; friable; medium acid; gradual boundary.

B2—33 to 44 inches; olive brown (2.5Y 4/4) silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate fine and medium subangular blocky; friable; few dark reddish brown (5YR 3/2) concretions; slightly acid; gradual boundary.

B3—44 to 48 inches; light olive brown (2.5Y 5/4) and grayish brown (2.5Y 5/2) silty clay loam; few fine prominent strong brown (7.5YR 5/6) and few fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; slightly acid; gradual boundary.

C—48 to 63 inches; light olive brown (2.5Y 5/4) heavy silt loam; strong brown (7.5YR 5/6) and grayish brown (10YR 5/2) mottles; weak coarse prismatic structure; friable; numerous dark reddish brown (5YR 3/2) concretions; neutral.

The solum typically is about 48 inches thick but ranges from 40 to 66 inches. The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), very dark gray (10YR 3/1),

or very dark grayish brown (10YR 3/2). Colors having value of 3 extend to a depth of 24 to 36 inches. The B horizon ranges from about 30 to 35 percent clay.

Fayette series

The Fayette series consists of well drained, moderately permeable soils that formed in more than 40 inches of loess. These soils are mainly on ridges and side slopes in the uplands, but in some small areas they are on benches adjacent to the major streams. Slope ranges from 2 to 40 percent.

Fayette soils are similar to Downs and Tama soils. Downs soils have a thicker dark colored A horizon than Fayette soils and a less distinct A2 horizon. Tama soils have a thicker, darker colored A horizon than Fayette soils and have no A2 horizon.

Typical pedon of Fayette silt loam, 2 to 5 percent slopes, 800 feet west and 600 feet north of the southeast corner of sec. 35, T. 79 N., R. 3 W.

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; friable; neutral; abrupt boundary.

A21—5 to 8 inches; dark grayish brown (10YR 4/2) silt loam; weak fine platy structure; friable; thin discontinuous light gray (10YR 7/2, dry) silt coatings on faces of peds; slightly acid; clear boundary.

A22—8 to 11 inches; dark brown (10YR 4/3) silt loam; weak fine platy structure parting to weak fine subangular blocky; friable; thin discontinuous light gray (10YR 7/2, dry) silt coatings on faces of peds; medium acid; clear boundary.

B1—11 to 17 inches; dark brown (10YR 4/3) light silty clay loam, dark yellowish brown (10YR 4/4) crushed; weak fine subangular blocky structure; friable; thin discontinuous light gray (10YR 7/2, dry) silt coatings on faces of peds; medium acid; gradual boundary.

B21t—17 to 24 inches; yellowish brown (10YR 5/4) silty clay loam; dark yellowish brown (10YR 4/4) coatings on faces of peds; moderate fine subangular and angular blocky structure; friable; thin discontinuous light gray (10YR 7/1, dry) silt coatings on faces of peds; thin discontinuous clay films on faces of peds; strongly acid; gradual boundary.

B22t—24 to 33 inches; yellowish brown (10YR 5/4) silty clay loam; dark yellowish brown (10YR 4/4) coatings on faces of peds; moderate medium subangular and angular blocky structure; friable; thin discontinuous light gray (10YR 7/1, dry) silt coatings on faces of peds; thin discontinuous clay films on faces of peds; strongly acid; gradual boundary.

B31t—33 to 50 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) silty clay loam; few medium distinct light brownish gray (2.5Y 6/2) mottles in the lower part; moderate medium prismatic structure parting to weak coarse subangular blocky; friable; few thin light gray (10YR 7/1, dry) silt coatings on faces of peds; thin discontinuous clay films on faces of peds; nearly continuous black (10YR 2/1) organic stains on some vertical faces; strongly acid; gradual boundary.

B32—50 to 58 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) light silty clay loam; few fine faint light brownish gray (10YR 6/2) mottles; weak medium to coarse prismatic structure; friable; few thin light gray (10YR 7/1, dry) silt coatings on faces of peds; black (10YR 2/1) organic stains on vertical faces; strongly acid; gradual boundary.

C—58 to 68 inches; yellowish brown (10YR 5/4) heavy silt loam; few fine faint light brownish gray (10YR 6/2) mottles; massive; friable; strongly acid.

The solum ranges from 45 to 60 inches or more in thickness. The A1 horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2) and is 2 to 5 inches thick. In cultivated areas the Ap horizon is dark grayish brown (10YR 4/2) or brown (10YR 4/3 or 5/3). The A2 horizon typically is dark grayish brown (10YR 4/2) or brown (10YR 4/3) but ranges to grayish brown (10YR 5/2) and brown (10YR 5/3). It is 4 to 8 inches thick. In eroded areas it is incorporated into the Ap horizon.

The B2t horizon has value of 4 or 5 and chroma of 3 or 4. It commonly has a clay content of 28 to 35 percent. Mottles that have hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2 typically are in the lower part of the B horizon and in the C horizon. Depth to these grayish mottles generally decreases as slope increases in convex areas. The B horizon ranges from medium acid to very strongly acid.

Franklin series

The Franklin series consists of somewhat poorly drained, moderately permeable soils that formed in 24 to 40 inches of loess and in the underlying glacial till. These soils are on upland divides and in concave areas at the head of drainageways. Slope ranges from 1 to 3 percent.

Franklin soils are similar to Dinsdale soils and are commonly adjacent to Dinsdale, Klinger, and Maxfield soils on the landscape. Dinsdale soils have a browner B horizon than Franklin soils and are better drained. Klinger soils have a thicker A horizon than Franklin soils. Maxfield soils are poorly drained and are lower on the landscape than Franklin soils.

Typical pedon of Franklin silt loam, 1 to 3 percent slopes, 760 feet north and 755 feet east of the southwest corner of sec. 18, T. 82 N., R. 2 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam; granular structure; friable; neutral; abrupt boundary.

A2—9 to 16 inches; dark grayish brown (10YR 4/2) silt loam; weak medium platy structure; friable; few dark reddish brown (5YR 3/2) concretions; few discontinuous very dark grayish brown (10YR 3/2) silt coatings on faces of peds; medium acid; clear boundary.

B1—16 to 20 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine faint yellowish brown (10YR 5/4 and 5/6) mottles; weak fine subangular blocky structure; friable; few dark reddish brown (5YR 3/2) concretions; strongly acid; gradual boundary.

B21t—20 to 31 inches; grayish brown (10YR 5/2) silty clay loam; many fine distinct strong brown (7.5YR 5/6) mottles; moderate fine and medium subangular blocky structure; friable; few dark reddish brown (5YR 3/2) concretions; few thin discontinuous clay films on faces of peds; strongly acid; gradual boundary.

B22t—31 to 37 inches; grayish brown (10YR 5/2) silty clay loam; many medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; few thin discontinuous clay films on faces of peds; few light gray (10YR 7/1, dry) silt coatings on faces of peds; strongly acid; abrupt boundary.

IIB23t—37 to 48 inches; yellowish brown (10YR 5/8) loam; many medium distinct light brownish gray (2.5Y 6/2) mottles; weak medium prismatic structure; firm; pebble band at 37 to 38 inches; medium acid; gradual boundary.

IIB3—48 to 62 inches; yellowish brown (10YR 5/6) heavy loam; many medium light brownish gray (2.5Y 6/2) mottles; weak coarse prismatic structure; firm; medium acid.

The solum typically is more than 48 inches thick but ranges from 40 to about 70 inches. The loess is typically 24 to 40 inches thick.

The Ap horizon is black (10YR 2/1), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2). It is 6 to 10 inches thick. The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 2. It is about 4 to 8 inches thick.

The upper part of the B horizon is dark grayish brown (10YR 4/2 or 2.5Y 4/2) or grayish brown (10YR 5/2). It ranges from 28 to 34 percent clay. It is strongly acid to medium acid.

In most places a stone line or a thin lens of sandy material at a depth of 24 to 40 inches separates the silty upper part of the B horizon from the loamy lower part. The IIB horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It typically is loam, but in places it is clay loam or sandy clay loam.

Garwin series

The Garwin series consists of poorly drained, moderately slowly permeable soils that formed in more than 40 inches of loess. These soils are in concave areas at the head of upland drainageways and on broad upland flats. Slope ranges from 0 to 2 percent.

Garwin soils are similar to Tama soils and are commonly adjacent to Atterberry, Muscatine, and Tama soils on the landscape. Atterberry and Muscatine soils have a thinner dark colored A horizon than Garwin soils and are better drained. Tama soils also are better drained and have a browner B horizon.

Typical pedon of Garwin silty clay loam, 0 to 2 percent slopes, 500 feet south and 920 feet east of the northwest corner of sec. 13, T. 80 N., R. 1 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam; weak fine granular structure; friable; neutral; abrupt boundary.

A12—8 to 14 inches; black (10YR 2/1) silty clay loam; moderate fine granular structure; friable; neutral; clear boundary.

B1g—14 to 23 inches; dark gray (10YR 4/1) heavy silty clay loam; common fine faint dark grayish brown (10YR 4/2) and light olive brown (2.5Y 5/4) mottles; moderate fine subangular blocky structure; friable; neutral; gradual boundary.

B2g—23 to 29 inches; dark grayish brown (2.5Y 4/2) silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; neutral; gradual boundary.

B3g—29 to 39 inches; grayish brown (2.5Y 5/2) light silty clay loam; few medium distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; neutral; gradual boundary.

C—39 to 60 inches; grayish brown (2.5Y 5/2) silt loam; few medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; mildly alkaline.

The solum ranges from 36 to 50 inches in thickness. The A1 or Ap horizon is black (N 2/0) or very dark gray (10YR 3/1). The A horizon ranges from 14 to 23 inches in thickness. The B2 horizon has hue of 5Y or 2.5Y, value of 3 to 5, and chroma of 1 or 2. The B horizon ranges from 30 to 37 percent clay.

Hanlon series

The Hanlon series consists of moderately well drained, moderately rapidly permeable soils that formed in coarse and moderately coarse textured alluvium on low benches, natural levees, and bottom land. Slope ranges from 0 to 2 percent.

The Hanlon soils in this county have a browner C horizon than is defined as the range for the Hanlon

series. Also, they have no B horizon. These differences, however, do not alter the use or behavior of the soils.

Hanlon soils are similar to Spillville soils and are commonly adjacent to Colo and Spillville soils on the landscape. Colo soils contain more clay than Hanlon soils and are poorly drained. Spillville soils contain less clay in the A horizon.

Typical pedon of Hanlon fine sandy loam, 0 to 2 percent slopes, 360 feet south and 520 feet east of the northwest corner of sec. 12, T. 79 N., R. 3 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) fine sandy loam; weak fine granular structure; very friable; neutral; clear boundary.

A12—7 to 24 inches; very dark brown (10YR 2/2) fine sandy loam; weak medium subangular blocky structure; very friable; neutral; gradual boundary.

A13—24 to 30 inches; very dark brown (10YR 2/2) fine sandy loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak coarse subangular blocky structure parting to weak fine granular; very friable; neutral; gradual boundary.

A14—30 to 42 inches; very dark grayish brown (10YR 3/2) fine sandy loam; weak coarse subangular blocky structure; very friable; neutral; abrupt boundary.

C—42 to 60 inches; dark brown (10YR 4/3) loamy fine sand; weak coarse prismatic structure parting to single grain; very friable; slightly acid.

The solum ranges from 40 to 72 inches in thickness. The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). It is typically fine sandy loam, but in some pedons it is sandy loam.

Judson series

The Judson series consists of well drained and moderately well drained, moderately permeable soils that formed in sediment washed from adjacent loess-covered hillsides. These soils are on foot slopes and fans where waterways empty onto bottom land. Slope ranges from 2 to 5 percent.

Judson soils are similar to Ely soils and are commonly adjacent to Ely and Kennebec soils on the landscape. Ely soils have a grayer B horizon than Judson soils and are somewhat poorly drained. Kennebec soils have a thicker dark colored A horizon than Judson soils.

Typical pedon of Judson silt loam, 2 to 5 percent slopes, 100 feet east and 90 feet north of the southwest corner of SE1/4 sec. 19, T. 79 N., R. 3 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) kneaded; weak fine granular structure; friable; slightly acid; abrupt boundary.

A12—8 to 16 inches; very dark brown (10YR 2/2) light silty clay loam; weak fine granular structure; friable; slightly acid; gradual boundary.

A13—16 to 22 inches; very dark brown (10YR 2/2) light silty clay loam; weak fine subangular blocky structure; friable; slightly acid; gradual boundary.

A3—22 to 28 inches; very dark grayish brown (10YR 3/2) light silty clay loam; weak fine subangular blocky structure; friable; slightly acid; gradual boundary.

B1—28 to 36 inches; dark yellowish brown (10YR 4/4) silty clay loam; dark brown (10YR 3/3) coatings on faces of peds; moderate fine subangular blocky structure; friable; slightly acid; gradual boundary.

B2—36 to 44 inches; dark yellowish brown (10YR 4/4) silty clay loam; dark brown (10YR 4/3) coatings on faces of peds; moderate medium subangular blocky structure; friable; medium acid; gradual boundary.

B3—44 to 51 inches; dark yellowish brown (10YR 4/4) light silty clay loam; yellowish brown (10YR 5/4) coatings on faces of peds; few fine faint yellowish brown (10YR 5/6) and light gray (10YR 7/2) mottles; moderate medium prismatic structure parting to weak coarse subangular blocky; friable; few light gray (10YR 7/2, dry) silt coatings on faces of peds; slightly acid; gradual boundary.

C—51 to 61 inches; yellowish brown (10YR 5/4) heavy silt loam; few fine faint light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure; friable; few very dark gray (10YR 3/1) clay films in root channels; few light gray (10YR 7/2, dry) silt coatings on faces of peds; neutral.

The solum ranges from 48 to 60 inches or more in thickness. The A horizon ranges from 24 to 36 inches in thickness. It is black (10YR 2/1) or very dark brown (10YR 2/2) in the upper part and ranges to very dark grayish brown (10YR 3/2) in the lower part. It is silt loam or silty clay loam. The clay content ranges from 24 to 30 percent.

The B horizon has value of 3 to 5 and chroma of 3 to 6. It is medium acid or slightly acid. In places the upper part of the B horizon has darker coated ped exteriors. A few low chroma mottles are below a depth of 30 inches in places.

Kennebec series

The Kennebec series consists of moderately well drained, moderately permeable soils that formed in silty and loamy alluvium. These soils are on flood plains. Slope ranges from 0 to 2 percent.

Kennebec soils are similar to Colo soils and are commonly adjacent to Nodaway and Spillville soils on the landscape. Colo soils contain more clay throughout the profile than Kennebec soils and are more poorly drained. Nodaway soils are lighter colored than Kennebec soils

and are stratified. Spillville soils contain more sand than Kennebec soils.

Typical pedon of Kennebec silt loam, 0 to 2 percent slopes, 60 feet west and 100 feet south of the northeast corner of NW1/4 sec. 35, T. 80 N., R. 2 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam; weak fine granular and subangular blocky structure; friable; neutral; abrupt boundary.

A12—8 to 22 inches; very dark brown (10YR 2/2) silt loam; weak coarse platy structure parting to moderate fine subangular blocky; friable; a thin stratum of grayish brown (10YR 5/2) silt loam at 21 inches; neutral; gradual boundary.

A13—22 to 38 inches; black (10YR 2/1) silt loam; weak medium platy structure parting to weak fine subangular blocky; friable; grayish brown (10YR 5/2) silt loam strata between 27 and 28 inches; neutral; gradual boundary.

A14—38 to 55 inches; black (10YR 2/1) silt loam; weak fine subangular blocky and granular structure; friable; neutral; gradual boundary.

C—55 to 71 inches; very dark grayish brown (10YR 3/2) loam; weak fine subangular blocky and granular structure; friable; neutral.

The solum is 36 to 60 inches thick. The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark gray (10YR 3/1). The hue commonly is 10YR in the A and C horizons, but in places it is 2.5Y in the C horizon. The content of clay typically is 24 to 30 percent, but the range is wider below a depth of 40 inches. The A horizon typically is slightly acid or neutral, but the upper part ranges to medium acid in some pedons.

Kenyon series

The Kenyon series consists of moderately well drained, moderately permeable soils on uplands. These soils formed in 14 to 26 inches of loamy material and in the underlying glacial till. They are on ridgetops and side slopes. Slope ranges from 2 to 9 percent.

Kenyon soils are similar to Bassett soils and are commonly adjacent to Bassett, Dinsdale, and Waubeek soils on the landscape. Bassett soils have a thinner dark colored A horizon than Kenyon soils. Dinsdale and Waubeek soils contain less sand in the upper part of the solum than Kenyon soils and are deeper to glacial till.

Typical pedon of Kenyon loam, 5 to 9 percent slopes, 1,680 feet north and 400 feet east of the center of sec. 23, T. 81 N., R. 4 W.

Ap—0 to 9 inches; very dark brown (10YR 2/2) loam; granular structure; friable; slightly acid; abrupt boundary.

A12—9 to 12 inches; very dark grayish brown (10YR 3/2) loam; weak fine granular structure; friable; medium acid; clear boundary.

A3—12 to 18 inches; very dark grayish brown (10YR 3/2) loam; weak fine subangular blocky structure; friable; medium acid; clear boundary.

IIB1—18 to 25 inches; dark brown (10YR 4/3) heavy loam; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; moderate fine and medium subangular blocky structure; firm; discontinuous pebble band at 24 inches; strongly acid; clear boundary.

IIB21—25 to 31 inches; dark yellowish brown (10YR 4/4) heavy loam; dark brown (10YR 4/3) coatings on faces of peds; moderate fine and medium subangular blocky structure; firm; strongly acid; gradual boundary.

IIB22—31 to 45 inches; yellowish brown (10YR 5/6) heavy loam; yellowish brown (10YR 5/4) coatings on faces of peds; few fine faint grayish brown (10YR 5/2) mottles; moderate medium prismatic structure; firm; strongly acid; gradual boundary.

IIB3—45 to 60 inches; yellowish brown (10YR 5/6) heavy loam; common fine faint grayish brown (10YR 5/2) mottles; weak coarse prismatic structure; firm; numerous dark reddish brown (5YR 3/2) concretions; slightly acid; gradual boundary.

IIC—60 to 70 inches; yellowish brown (10YR 5/6) heavy loam; many fine faint grayish brown (10YR 5/2) mottles; massive; firm; numerous dark reddish brown (5YR 3/2) concretions; neutral.

The solum ranges from 45 to 66 inches in thickness. The depth to firm loam glacial till is about 14 to 26 inches. The depth to carbonates ranges from 45 to 66 inches.

The Ap or A1 horizon is black (10YR 2/1) or very dark brown (10YR 2/2). In uneroded areas the thickness of the A horizon ranges from about 10 to 20 inches; it commonly decreases as slope increases. This horizon typically is loam but ranges to silt loam that is high in content of sand.

The IIB horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 8. Mottles have chroma of 2 or lower. This horizon typically is heavy loam but ranges to clay loam and sandy clay loam. It is slightly acid to strongly acid. The color and texture of the IIC horizon are similar to those of the IIB horizon, but the grayish mottles are more numerous.

Kenyon loam, 5 to 9 percent slopes, moderately eroded, lacks a mollic epipedon, which is definitive for the Kenyon series. This difference, however, does not alter the use or behavior of the soil.

Klinger series

The Klinger series consists of somewhat poorly drained, moderately permeable soils that formed in 24 to 40 inches of loess and in the underlying glacial till. These soils are on broad ridges or flats, foot slopes, and side slopes on uplands. Slope ranges from 1 to 3 percent.

Klinger soils are similar to Dinsdale soils and are commonly adjacent to Dinsdale, Franklin, and Maxfield soils on the landscape. Dinsdale soils have a browner B horizon than Klinger soils and are better drained. Franklin soils have a thinner dark colored A horizon than Klinger soils. Maxfield soils are poorly drained and are lower on the landscape than Klinger soils.

Typical pedon of Klinger silt loam, 1 to 3 percent slopes, 220 feet east and 200 feet north of the center of SE1/4 sec. 13, T. 82 N., R. 3 W.

Ap—0 to 9 inches; black (10YR 2/1) silt loam; weak fine granular structure; friable; slightly acid; abrupt boundary.

A12—9 to 15 inches; very dark brown (10YR 2/2) light silty clay loam; moderate fine granular structure; friable; medium acid; gradual boundary.

A3—15 to 18 inches; very dark grayish brown (10YR 3/2) light silty clay loam; moderate fine subangular blocky structure; friable; medium acid; gradual boundary.

B21t—18 to 26 inches; dark grayish brown (2.5Y 4/2) silty clay loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; few fine distinct light olive brown (2.5Y 5/4) mottles; moderate fine subangular blocky structure; friable; thin discontinuous clay films on faces of peds; medium acid; gradual boundary.

B22t—26 to 35 inches; grayish brown (2.5Y 5/2) silty clay loam; many fine faint light olive brown (2.5Y 5/4) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; friable; thin nearly continuous clay films on faces of peds; slightly acid; gradual boundary.

B23t—35 to 39 inches; mottled grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/4) light silty clay loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; thin nearly continuous clay films on faces of peds; slightly acid; abrupt boundary.

IIB3t—39 to 47 inches; mottled yellowish brown (10YR 5/6) and grayish brown (2.5Y 5/2) heavy loam; weak coarse prismatic structure; firm; thin discontinuous clay films on faces of peds; pebble band at 39 to 40 inches; slightly acid; gradual boundary.

IIC—47 to 60 inches; mottled yellowish brown (10YR 5/6) and light brownish gray (2.5Y 6/2) heavy loam; massive; firm; neutral.

The solum ranges from about 40 to 60 inches in thickness. The A horizon is typically black (10YR 2/1) or very dark brown (10YR 2/2). It grades to value of 3 and has chroma of 1 or 2 in the lower part. It ranges from 16 to 22 inches in thickness. Reaction is slightly acid to strongly acid in the A horizon and in the upper part of the B horizon.

The B2t horizon is dark grayish brown (10YR 4/2 or 2.5Y 4/2), grayish brown (2.5Y 5/2), or light olive brown (2.5Y 5/4). It ranges from 28 to 35 percent clay. The mottled IIBt horizon is grayish brown (2.5Y 5/2), light brownish gray (2.5Y 6/2), or yellowish brown (10YR 5/4, 5/6). It is loam or clay loam.

Lamont series

The Lamont series consists of well drained soils that are moderately rapidly permeable in the upper part and very rapidly permeable in the lower part. These soils are on upland ridges and side slopes and on high stream benches. They formed in dominantly wind-deposited sand. Slope ranges from 2 to 18 percent.

Lamont soils are similar to Dickinson soils and are commonly adjacent to Chelsea and Fayette soils on the landscape. Chelsea soils contain more sand in the A horizon than Lamont soils. Dickinson soils have a thicker dark colored A1 horizon than Lamont soils. Fayette soils formed in loess and are silty.

Typical pedon of Lamont fine sandy loam, 2 to 9 percent slopes, 200 feet north and 80 feet east of the southwest corner of NE1/4SW1/4 sec. 1, T. 79 N., R. 3 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) fine sandy loam; dark brown (10YR 4/3) coatings on faces of peds; weak fine granular structure; very friable; neutral; abrupt boundary.

A2—6 to 9 inches; dark grayish brown (10YR 4/2) sandy loam; weak fine platy structure; very friable; slightly acid; clear boundary.

B1—9 to 17 inches; dark brown (7.5YR 4/4) light loam; weak fine subangular blocky structure; friable; strongly acid; gradual boundary.

B2t—17 to 24 inches; brown (7.5YR 5/4) sandy loam; dark brown (7.5YR 4/4) coatings on faces of peds; weak medium prismatic structure parting to moderate medium subangular blocky; friable; light gray (10YR 7/2, dry) sandy coatings on faces of peds; dark brown (7.5YR 3/2) clay films on faces of peds; strongly acid; clear boundary.

B31t—24 to 32 inches; strong brown (7.5YR 5/6) sandy loam; brown (7.5YR 5/4) coatings on faces of peds; weak coarse prismatic structure parting to weak medium subangular blocky; very friable; light gray (10YR 7/2, dry) sandy coatings on faces of peds; dark brown (7.5YR 3/2) clay films on faces of peds; strongly acid; clear boundary.

B32—32 to 37 inches; strong brown (7.5YR 5/6) loamy sand; weak coarse prismatic structure; very friable; strongly acid; clear boundary.

C—37 to 65 inches; light yellowish brown (10YR 6/4) fine sand and sand; single grain; loose; 1/2- to 2-inch bands of brown (7.5YR 4/4) loamy sand at depths of 39, 46, 52, and 62 inches; strongly acid.

The solum ranges from 30 to 60 inches in thickness. The Ap or A1 horizon is dark grayish brown (10YR 4/2), dark gray (10YR 4/1), or very dark gray (10YR 3/1). In uneroded areas the A2 horizon is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2). In places it is incorporated into the Ap horizon. The B2 horizon is sandy loam, loam, or sandy clay loam. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It ranges from medium acid to strongly acid.

Lindley series

The Lindley series consists of moderately well drained, moderately slowly permeable soils that formed in loamy glacial till. These soils are on valley sides and narrowly dissected interfluves. Slope ranges from 9 to 25 percent.

Lindley soils are similar to Bassett soils and are commonly adjacent to Downs and Fayette soils. They have a lighter colored surface layer than Bassett soils. Downs and Fayette soils formed in loess.

Typical pedon of Lindley loam, 18 to 25 percent slopes, moderately eroded, 700 feet north and 60 feet east of the southwest corner of sec. 16, T. 81 N., R. 1 W.

Ap—0 to 4 inches; dark grayish brown (10YR 4/2) loam; moderate fine granular structure; friable; mixing of yellowish brown (10YR 5/6); medium acid; abrupt boundary.

B1—4 to 7 inches; yellowish brown (10YR 5/6) loam; yellowish brown (10YR 5/4) coatings on faces of peds; weak fine subangular blocky structure; firm; strongly acid; clear boundary.

B21—7 to 14 inches; yellowish brown (10YR 5/6) heavy loam; yellowish brown (10YR 5/4) coatings on faces of peds; moderate fine subangular blocky structure; firm; strongly acid; gradual boundary.

B22t—14 to 20 inches; yellowish brown (10YR 5/6) clay loam; yellowish brown (10YR 5/4) coatings on faces of peds; few fine faint gray (10YR 6/1) mottles; moderate medium subangular blocky structure; firm; discontinuous clay films on vertical faces of peds; strongly acid; gradual boundary.

B23t—20 to 36 inches; yellowish brown (10YR 5/6) clay loam; yellowish brown (10YR 5/4) coatings on faces of peds; few fine faint light brownish gray (10YR 6/2) mottles; moderate medium prismatic structure parting to moderate coarse subangular blocky; firm; continuous clay films on faces of peds; few dark brown (7.5YR 3/4) concretions; strongly acid; gradual boundary.

C—36 to 60 inches; yellowish brown (10YR 5/4) clay loam; common medium faint gray (10YR 6/1) mottles; moderate medium prismatic structure; firm; clay films on faces of prisms; neutral.

The solum ranges from 30 to 50 inches in thickness. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The A1 horizon, if it occurs, ranges from very dark gray (10YR 3/1) to dark grayish brown (10YR 4/2). The Ap or A1 horizon dominantly is loam, but in some pedons it is silt loam. An A2 horizon is evident in uncultivated areas. It has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The B2 horizon typically is mottled in the lower part.

Maxfield series

The Maxfield series consists of poorly drained, moderately permeable soils that formed in 36 to 48 inches of loess and in the underlying glacial till. These soils are in slight depressions on upland flats and in shallow drainageways. Slope ranges from 0 to 2 percent.

The Maxfield soils in this county are outside the range defined for the Maxfield series because the loess is thicker than 40 inches. This difference, however, does not alter the use and behavior of the soils.

Maxfield soils are similar to Dinsdale soils and are commonly adjacent to Dinsdale, Franklin, and Klinger soils on the landscape. Dinsdale soils have a browner B horizon than Maxfield soils and are better drained. Franklin and Klinger soils are somewhat poorly drained and generally are higher on the landscape than Maxfield soils.

Typical pedon of Maxfield silty clay loam, 0 to 2 percent slopes, 760 feet east and 80 feet north of the southwest corner of SW1/4SW1/4 sec. 18, T. 82 N., R. 2 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam; granular structure; friable; neutral; abrupt boundary.

A12—8 to 17 inches; black (10YR 2/1) silty clay loam; weak fine granular structure; friable; neutral; gradual boundary.

A3—17 to 23 inches; very dark gray (10YR 3/1) silty clay loam; weak fine subangular blocky structure; friable; slightly acid; clear boundary.

B21—23 to 32 inches; grayish brown (2.5Y 5/2) silty clay loam; many fine distinct yellowish brown (10YR 5/4 and 10YR 5/6) mottles; moderate fine and medium subangular blocky structure; friable; few dark gray (10YR 4/1) clay flows; slightly acid; gradual boundary.

B22—32 to 45 inches; grayish brown (2.5Y 5/2) silty clay loam; many medium and coarse prominent yellowish

brown (10YR 5/6) mottles; moderate fine and medium prismatic structure; friable; neutral; abrupt boundary.

IIB3—45 to 54 inches; mottled yellowish brown (10YR 5/6) and light brownish gray (2.5Y 6/2) heavy loam; weak coarse prismatic structure; firm; mottled yellowish brown (10YR 5/6) and light olive gray (5Y 6/2) sand lenses at 45 to 48 inches; numerous dark brown concretions; neutral; gradual boundary.

IIC—54 to 70 inches; mottled yellowish brown (10YR 5/8) and light brownish gray (2.5Y 6/2) heavy loam; massive; firm; neutral.

The solum typically is about 54 inches thick but ranges from about 40 to 55 inches. The loess typically is 36 to 48 inches thick. Carbonates are at a depth of about 40 to 60 inches.

The A horizon is black (N 2/0 or 10YR 2/1) and very dark gray (10YR 3/1 or 5Y 3/1). The upper part of the B horizon has hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 1 or 2. The IIB3 horizon has hue of 2.5Y or 10YR, value of 5 or 6, and chroma of 2 to 6. It typically is loam, but the range includes clay loam and sandy clay loam. A thin layer of loamy sand or sand, typically less than 10 inches thick, commonly separates the B and the IIB horizons. The IIC horizon has the same color and texture as the IIB3 horizon.

Muscatine series

The Muscatine series consists of somewhat poorly drained, moderately permeable soils that formed in more than 40 inches of loess. These soils generally are on broad upland divides, foot slopes, and side slopes in the uplands. In some areas they are on loess-covered stream benches. Slope ranges from 0 to 5 percent.

Muscatine soils are similar to Tama soils and are commonly adjacent to Atterberry, Garwin, and Tama soils on the landscape. Atterberry soils have a thinner dark colored A horizon than Muscatine soils. Garwin soils are poorly drained and are lower on the landscape than Muscatine soils. Tama soils have a browner B horizon than Muscatine soils and are better drained.

Typical pedon of Muscatine silt loam, 0 to 2 percent slopes, 500 feet west and 60 feet north of the center of sec. 22, T. 81 N., R. 1 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam; weak fine granular structure; friable; neutral; clear boundary.

A12—8 to 12 inches; black (10YR 2/1) light silty clay loam; weak fine granular structure; friable; medium acid; clear boundary.

A13—12 to 18 inches; very dark brown (10YR 2/2) silty clay loam; weak medium granular structure; friable; medium acid; clear boundary.

B1—18 to 23 inches; very dark grayish brown (10YR 3/2) silty clay loam; weak fine subangular blocky structure; friable; medium acid; gradual boundary.

B21t—23 to 28 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate fine subangular blocky structure; friable; few discontinuous clay films on faces of peds; medium acid; gradual boundary.

B22t—28 to 34 inches; dark grayish brown (10YR 4/2) silty clay loam; many fine faint yellowish brown (10YR 5/6 and 10YR 5/4) mottles; moderate fine subangular blocky structure; friable; few thin discontinuous clay films on faces of peds; medium acid; gradual boundary.

B31t—34 to 42 inches; mottled dark grayish brown (2.5Y 4/2) and yellowish brown (10YR 5/6) silty clay loam; moderate fine prismatic structure; friable; few dark brown (7.5YR 4/4) concretions; few thin discontinuous clay films on faces of peds; slightly acid; gradual boundary.

B32—42 to 48 inches; mottled grayish brown (2.5Y 5/2) and strong brown (7.5YR 5/6) silty clay loam; moderate medium prismatic structure; friable; few clay flows in old root channels; common dark reddish brown (5YR 3/3) concretions; slightly acid; gradual boundary.

C—48 to 60 inches; light brownish gray (2.5Y 6/2) silt loam; many fine distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8) mottles; massive; friable; common dark reddish brown (5YR 3/3) concretions; neutral.

The solum ranges from 40 to 60 inches in thickness. The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). It ranges from 14 to 20 inches in thickness. It is silty clay loam or silt loam. The B horizon is strongly acid to slightly acid. It generally has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2. The mottles have a higher chroma. The B2 horizon ranges from about 27 to 35 percent clay.

Nevin series

The Nevin series consists of somewhat poorly drained, moderately permeable soils that formed in silty clay loam alluvium. These soils are on stream benches along the major drainageways. Slope ranges from 0 to 2 percent.

The Nevin soils in this county have a thinner mollic epipedon than is defined as the range for the Nevin series. This difference, however, does not alter the use or behavior of the soils.

Nevin soils are similar to Richwood soils and are commonly adjacent to Atterberry, Colo, Kennebec, Richwood, and Sawmill soils on the landscape. Atterberry soils have a thinner dark colored A horizon than Nevin soils. Colo, Sawmill, and Kennebec soils have a thicker dark colored A horizon. Colo and Sawmill soils are

poorly drained, and Kennebec soils are moderately well drained. Richwood soils are well drained and do not have a silty clay loam B horizon.

Typical pedon of Nevin silty clay loam, 0 to 2 percent slopes, 140 feet south and 2,000 feet west of the northeast corner of sec. 35, T. 79 N., R. 4 W.

A11—0 to 9 inches; black (10YR 2/1) silty clay loam; weak fine granular structure; friable; medium acid; clear boundary.

A12—9 to 16 inches; black (10YR 2/1) silty clay loam; moderate medium granular structure; medium acid; gradual boundary.

B1—16 to 24 inches; dark grayish brown (2.5Y 4/2) silty clay loam; very dark gray (10YR 3/1) coatings on faces of peds; moderate fine subangular blocky structure; friable; medium acid; gradual boundary.

B21t—24 to 34 inches; dark grayish brown (2.5Y 4/2) silty clay loam; grayish brown (2.5Y 5/2) coatings on faces of peds; few fine faint distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; friable; thin discontinuous clay films on faces of peds; thin discontinuous light gray (10YR 7/2, dry) silt coatings on faces of peds; medium acid; gradual boundary.

B22t—34 to 48 inches; grayish brown (2.5Y 5/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; thin discontinuous clay films on faces of peds; few thin discontinuous light gray (10YR 7/2, dry) silt coatings on faces of peds; medium acid; gradual boundary.

B3—48 to 58 inches; light brownish gray (2.5Y 6/2) silty clay loam; many medium prominent strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure; friable; slightly acid; gradual boundary.

C—58 to 68 inches; light brownish gray (2.5Y 6/2) silty clay loam; many medium prominent strong brown (7.5YR 5/6) mottles; massive; friable; numerous dark brown (7.5YR 3/2) oxide concretions; neutral.

The solum typically is more than 40 inches thick but ranges from 36 to 60 inches or more. The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2). It is 16 to 20 inches thick. It typically is silty clay loam, but the range includes silt loam. The B horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 or 3. It is medium acid or slightly acid.

Nodaway series

The Nodaway series consists of moderately well drained, moderately permeable soils that formed in recently deposited silty alluvium. These soils are stratified because each flood deposits fresh sediment. They are on flood plains, alluvial fans, and narrow upland waterways. Slope ranges from 0 to 2 percent.

Nodaway soils are similar to Arenzville soils and are commonly adjacent to Arenzville, Colo, and Kennebec soils on the landscape. In Arenzville soils 20 to 40 inches of recent alluvium overlies a buried soil. Colo soils have a higher clay content than Nodaway soils and are poorly drained. Kennebec soils are darker than Nodaway soils and less stratified.

Typical pedon of Nodaway silt loam, 0 to 2 percent slopes, 760 feet east and 1,530 feet south of the northwest corner of sec. 11, T. 80 N., R. 4 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; friable; thin strata of grayish brown (10YR 5/2) and brown (10YR 5/3) silt loam; neutral; clear boundary.

C1—7 to 20 inches; dark grayish brown (10YR 4/2) silt loam; weak thin to thick platy structure parting to weak fine granular; friable; thin strata of grayish brown (10YR 5/2) silt loam; neutral; clear boundary.

C2—20 to 60 inches; mixed dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), and brown (10YR 5/3) silt loam; weak thin to thick platy structure parting to weak fine granular; friable; neutral.

An A1 horizon is in uncultivated areas. It is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2), is 6 to 10 inches thick, and commonly is stratified. The C horizon dominantly has hue of 10YR, value of 3 to 5, and chroma of 2 or 3. Some strata have chroma of 1. A dark, medium textured or moderately fine textured buried soil is below a depth of 40 inches in places. In the upper 40 inches, material coarser than silt loam occurs only as thin lenses. Sandy material is below a depth of 40 inches in places. Reaction is slightly acid or neutral throughout the profile.

Palms series

The Palms series consists of very poorly drained soils that are moderately rapidly permeable in the upper part and moderately permeable in the substratum. These soils generally are in broad drainageways or on seepy hillsides. In a few areas they are on stream benches. They formed in organic material 16 to 50 inches deep over alluvial sediment or glacial till. Slope ranges from 1 to 3 percent.

Palms soils commonly are adjacent to Colo and Sawmill soils on the landscape. Colo and Sawmill soils do not have a surface layer of decomposed organic material and are better drained than Palms soils.

Typical pedon of Palms muck, 1 to 3 percent slopes, 635 feet south and 280 feet west of the northeast corner of sec. 23, T. 79 N., R. 4 W.

Oa1—0 to 6 inches; black (N 2/0) sapric material; weak fine granular structure; very friable; mildly alkaline; gradual boundary.

Oa2—6 to 13 inches; black (N 2/0) sapric material; massive; friable; mildly alkaline; gradual boundary.

Oa3—13 to 29 inches; very dark gray (10YR 3/1) sapric material; stratified; friable; few fibers that disintegrate when rubbed; thin strata of black (N 2/0) and dark gray (10YR 4/0) sapric material; slight effervescence; moderately alkaline; clear boundary.

IIC1—29 to 35 inches; very dark grayish brown (2.5Y 3/2) heavy silt loam; massive; friable; numerous fibers that disintegrate when rubbed; slight effervescence; moderately alkaline; gradual boundary.

IIC2—35 to 60 inches; greenish gray (5BG 5/1) heavy silt loam; massive; friable; numerous fibers that disintegrate when rubbed; slight effervescence; moderately alkaline.

The sapric material ranges from 16 to 50 inches in thickness. It is black (N 2/0), very dark gray (10YR 3/1), or very dark brown (10YR 2/2). The IIC horizon is silty clay loam, loam, or silt loam that in places has sandy strata. Reaction ranges from slightly acid to moderately alkaline throughout the profile.

Radford series

The Radford series consists of somewhat poorly drained, moderately permeable soils that formed in silt loam alluvium 20 to 40 inches deep over a buried dark colored silty clay loam. These soils are on flood plains and upland drainageways. Slope ranges from 0 to 2 percent.

Radford soils are similar to Arenzville soils and are commonly adjacent to Colo and Kennebec soils on the landscape. Arenzville soils are lighter in color than Radford soils. Colo soils generally do not have more than 20 inches of overwash. Kennebec soils contain less clay than Radford soils and have more than 40 inches of alluvium.

Typical pedon of Radford silt loam, 0 to 2 percent slopes, 940 feet west and 30 feet north of the southeast corner of SW1/4 sec. 19, T. 79 N., R. 3 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam; moderate very fine platy structure; friable; neutral; abrupt boundary.

A12—8 to 12 inches; very dark gray (10YR 3/1) silt loam; weak fine platy and weak fine granular structure; friable; neutral; gradual boundary.

C—12 to 26 inches; very dark gray (10YR 3/1) silt loam; weak medium platy structure parting to weak fine granular; friable; thin grayish brown (10YR 5/2) silt loam strata at 19 and 25 inches; neutral; clear boundary.

IIAb—26 to 46 inches; black (10YR 2/1) silty clay loam; weak medium subangular blocky structure parting to moderate medium granular; friable; neutral; gradual boundary.

IIB1b—46 to 54 inches; very dark gray (10YR 3/1) silty clay loam; weak medium prismatic structure parting to weak medium subangular blocky; firm; neutral; gradual boundary.

IIB2b—54 to 66 inches; olive gray (5Y 5/2) silty clay loam; light olive gray (5Y 6/2), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6) mottles; weak medium prismatic structure; firm; krotovinas with black clay flows; neutral.

Depth to the IIAb horizon ranges from 20 to 40 inches. The A and C horizons dominantly are black (10YR 2/1), very dark brown (10YR 2/2), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2). The C horizon typically has lighter colored strata. The IIAb and IIBb horizons are silty clay loam, clay loam, or loam. Reaction is slightly acid to mildly alkaline throughout the profile.

Richwood series

The Richwood series consists of well drained, moderately permeable soils that formed in silty alluvium. These soils are on benches along the major streams. Slope ranges from 0 to 2 percent.

The Richwood soils in this county are outside the limits defined as the range for the Richwood series because the content of clay is not higher in the A horizon than in the B horizon. This difference, however, does not alter the use or behavior of the soils.

Richwood soils are similar to Nevin soils and are commonly adjacent to Waukegan soils. Nevin soils have a grayer B horizon than Richwood soils and are not so well drained. Waukegan soils have contrasting texture of sand or loamy sand within a depth of 44 inches.

Typical pedon of Richwood silt loam, 0 to 2 percent slopes, 480 feet east and 1,760 feet south of the northwest corner of sec. 33, T. 81 N., R. 4 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam; weak fine subangular blocky and granular structure; friable; medium acid; abrupt boundary.

A12—8 to 14 inches; very dark brown (10YR 2/2) silt loam; weak fine granular structure; friable; medium acid; gradual boundary.

A13—14 to 19 inches; very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; friable; medium acid; gradual boundary.

B1—19 to 26 inches; dark yellowish brown (10YR 4/4) heavy silt loam; dark brown (10YR 3/3) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; gradual boundary.

B2—26 to 37 inches; dark yellowish brown (10YR 4/4) heavy silt loam; dark yellowish brown (10YR 3/4)

coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; gradual boundary.

B3—37 to 48 inches; dark yellowish brown (10YR 4/4) silt loam; dark brown (10YR 4/3) coatings on faces of peds; weak medium prismatic structure parting to weak medium subangular blocky; friable; 2-inch strata of coarse silt at 38 to 40 inches; medium acid; gradual boundary.

C—48 to 68 inches; yellowish brown (10YR 5/6) silt loam; massive; friable; one-fourth inch strata of very fine sand at 48 inches; medium acid.

The solum ranges from 45 to more than 65 inches in thickness. The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). It is 10 to 20 inches thick. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. The B2 horizon is silt loam or silty clay loam. The B3 horizon typically has a higher content of sand than the B2 horizon. It is silt loam or loam.

Rockton series

The Rockton series consists of well drained, moderately permeable soils that formed in 20 to 30 inches of loamy material and in a thin layer of limestone residuum underlain by limestone bedrock. These soils are on side slopes in the uplands. Slope ranges from 5 to 14 percent.

Rockton soils are similar to Kenyon soils and are commonly adjacent to Sogn soils on the landscape. Kenyon soils formed in glacial till and are not underlain by limestone bedrock. Sogn soils are shallower to bedrock than Rockton soils.

Typical pedon of Rockton loam, 20 to 30 inches to limestone, 5 to 14 percent slopes, 320 feet west and 980 feet north of the center of sec. 9, T. 82 N., R. 4 W.

A11—0 to 6 inches; very dark brown (10YR 2/2) loam; moderate medium granular structure; friable; slightly acid; gradual boundary.

A12—6 to 14 inches; very dark grayish brown (10YR 3/2) loam; very dark gray (10YR 3/1) coatings on faces of peds; moderate medium and fine granular structure; friable; slightly acid; gradual boundary.

B1—14 to 22 inches; dark brown (10YR 4/3) loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; moderate fine and medium subangular blocky structure; friable; discontinuous clay films on faces of peds; slightly acid; gradual boundary.

B21t—22 to 27 inches; dark brown (7.5YR 4/4) and reddish brown (5YR 4/4) sandy clay loam; moderate fine subangular blocky structure; friable; slightly acid; clear boundary.

IIB22t—27 to 29 inches; yellowish red (5YR 4/6) clay; moderate fine subangular blocky structure; firm; continuous clay films on faces of peds; neutral; abrupt boundary.

IIR—29 inches; shattered limestone bedrock; thin rinds of yellowish red (5YR 4/6) clay residuum in the fractured limestone.

The depth to limestone bedrock ranges from 20 to 30 inches. The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is 10 to 18 inches thick. It typically is loam, but in places it is silt loam. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is slightly acid to strongly acid. The B2t horizon ranges from about 25 to 35 percent clay. The IIB horizon is as much as 6 inches thick or occurs as clay flows around limestone flagstones. It is clay loam, clay, or silty clay.

Saude series

The Saude series consists of well drained soils that are moderately permeable in the upper part and very rapidly permeable in the lower part. These soils formed in loamy alluvial material 24 to 32 inches deep over sand and gravel. They are on stream benches and uplands. Slope ranges from 1 to 3 percent.

Saude soils are commonly adjacent to Dickinson and Waukegan soils. Dickinson soils do not have coarse sand and gravel in the lower part of the solum or in the C horizon. Waukegan soils contain more silt and less sand in the upper part of the solum than Saude soils.

Typical pedon of Saude loam, 1 to 3 percent slopes, 960 feet west and 1,220 feet north of the center of sec. 28, T. 81 N., R. 4 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) loam; weak fine subangular blocky structure; friable; medium acid; abrupt boundary.

A12—7 to 12 inches; very dark brown (10YR 2/2) loam; weak fine granular structure; friable; medium acid; gradual boundary.

A3—12 to 17 inches; dark brown (10YR 3/3) loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; gradual boundary.

B2—17 to 25 inches; dark yellowish brown (10YR 4/4) heavy loam; dark yellowish brown (10YR 4/3) coatings on faces of peds; weak medium subangular blocky structure; friable; medium acid; gradual boundary.

B31—25 to 29 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; friable; medium acid; gradual boundary.

IIB32—29 to 36 inches; dark yellowish brown (10YR 4/4) loamy sand; weak coarse subangular blocky structure; very friable; medium acid; gradual boundary.

IIC—36 to 60 inches; yellowish brown (10YR 5/6) sand and some gravel; single grain; loose; slightly acid.

The A1 and Ap horizons are black (10YR 2/1) or very dark brown (10YR 2/2) in uneroded areas. The A horizon ranges from 14 to 20 inches in thickness. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It ranges from 15 to 20 percent clay. It typically is medium acid but ranges from slightly acid to strongly acid. The C horizon is loamy sand, coarse loamy sand, or sand that contains some gravel. The depth to loamy sand, gravelly sand, or sand is commonly 24 to 32 inches but ranges from about 18 to 36 inches.

Sawmill series

The Sawmill series consists of poorly drained, moderately permeable soils that formed in moderately fine textured alluvial deposits. These soils are on flood plains and in upland drainageways. Slope ranges from 0 to 2 percent.

Sawmill soils are similar to Colo soils and are commonly adjacent to Colo, Kennebec, and Radford soils. Colo soils are dark colored to a depth of more than 40 inches. Kennebec soils are silt loam throughout the solum. Radford soils have a buried soil within the control section.

Typical pedon of Sawmill silty clay loam, 0 to 2 percent slopes, 80 feet east and 200 feet south of the northwest corner of NE1/4 sec. 35, T. 79 N., R. 4 W.

Ap—0 to 9 inches; black (N 2/0) silty clay loam; weak medium subangular blocky structure; friable; slightly acid; clear boundary.

A12—9 to 14 inches; black (N 2/0) silty clay loam; weak fine granular structure; firm; slightly acid; clear boundary.

A13—14 to 20 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) crushed; moderate fine granular and weak very fine subangular blocky structure; firm; neutral; clear boundary.

A3—20 to 33 inches; very dark gray (5Y 3/1) silty clay loam; moderate fine prismatic structure parting to moderate medium subangular blocky; firm; neutral; clear boundary.

B2g—33 to 45 inches; olive gray (5Y 5/2) and dark gray (5Y 4/1) silty clay loam; few fine faint yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; krotovinas at 43 to 45 inches; neutral; gradual boundary.

Cg—45 to 60 inches; light olive gray (5Y 6/2) silt loam; common fine prominent strong brown (7.5YR 5/6) mottles; massive; friable; mildly alkaline.

The solum ranges from 36 to 50 inches in thickness. The A horizon is black (10YR 2/1 or N 2/0), very dark brown (10YR 2/2), or very dark gray (10YR 3/1 or 5Y 3/1) and ranges from 22 to 35 inches in thickness. The B2g horizon has hue of 10YR to 5Y, value of 4 or higher, and chroma of 2 or less. Reaction is slightly acid or neutral throughout the solum.

Sogn series

The Sogn series consists of somewhat excessively drained, moderately permeable soils that formed in loamy material 4 to 20 inches deep over limestone bedrock. These soils are on short side slopes in the uplands. Slope ranges from 9 to 18 percent.

Sogn soils are commonly adjacent to Rockton soils on the landscape. They are less deep over limestone bedrock than those soils.

Typical pedon of Sogn loam, 9 to 18 percent slopes, 180 feet north and 1,615 feet east of the center of sec. 4, T. 80 N., R. 3 W.

A11—0 to 8 inches; black (10YR 2/1) loam; moderate medium granular structure; friable; neutral; gradual boundary.

A12—8 to 12 inches; very dark brown (10YR 2/2) loam; black (10YR 2/1) coatings on faces of peds; moderate medium granular and subangular blocky structure; friable; 5 to 15 percent limestone fragments 3 to 6 inches in diameter; neutral; abrupt boundary.

R—12 inches; shattered limestone; cracks filled with very dark brown (10YR 2/2) clay loam.

The depth to limestone is 4 to 20 inches. The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), very dark gray (10YR 3/1), or very dark grayish (10YR 3/2). It ranges from loam or silt loam that is high in content of sand to light clay loam. In places a 1- to 4-inch layer of clay or silty material is between the A horizon and the limestone.

Sparta series

The Sparta series consists of excessively drained, rapidly permeable soils that formed in sand deposited dominantly by wind. These soils are on stream benches and uplands. Slope ranges from 1 to 18 percent.

Sparta soils are commonly adjacent to Chelsea, Dickinson, and Kenyon soils on the landscape. Chelsea soils have a thinner dark colored A horizon than Sparta soils. Dickinson soils contain less sand in the A and B horizons than Sparta soils. Kenyon soils formed in glacial till and typically have a loam texture throughout the profile.

Typical pedon of Sparta loamy fine sand, 1 to 5 percent slopes, 400 feet east and 40 feet north of the southwest corner of sec. 1, T. 79 N., R. 3 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loamy fine sand; weak very fine granular structure; very friable; medium acid; abrupt boundary.

A12—7 to 21 inches; dark brown (7.5YR 3/2) loamy fine sand; weak medium subangular blocky structure; very friable; medium acid; gradual boundary.
A3—21 to 28 inches; dark brown (10YR 3/3) loamy fine sand; single grain; loose; medium acid; gradual boundary.
B2—28 to 47 inches; dark brown (7.5YR 4/4) fine sand and sand; single grain; loose; medium acid; gradual boundary.
C—47 to 64 inches; strong brown (7.5YR 5/6) sand; single grain; loose; medium acid.

The solum ranges from 24 to more than 40 inches in thickness. Reaction generally is strongly acid or medium acid throughout the profile, but it varies widely in the Ap horizon as a result of local liming practices.

The A horizon is loamy fine sand, loamy sand, or fine sand. It has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. Dark colored material ranges from 15 to 30 inches in thickness. The B horizon has hue of 10YR or 7.5YR and value and chroma of 3 to 6. It is sand and fine sand, loamy sand, or loamy fine sand.

Sperry series

The Sperry series consists of very poorly drained or poorly drained, slowly permeable or very slowly permeable soils that formed in more than 40 inches of loess. These soils are on uplands. Slope is 0 to 1 percent.

The Sperry soils in this county have a slightly thinner A1 horizon and a slightly thicker A2 horizon than is defined as the range for the Sperry series. Also, the B21 horizon has a lower color value. These differences, however, do not alter the use or behavior of the soils.

Sperry soils are commonly adjacent to Atterberry, Garwin, Muscatine, and Tama soils on the landscape. Atterberry soils are better drained than Sperry soils, and Garwin soils have a thicker, darker A horizon. Muscatine soils are better drained and have a thicker, darker A horizon. Tama soils have a browner B horizon and are better drained.

Typical pedon of Sperry silt loam, 0 to 1 percent slopes, 180 feet east and 100 feet south of the center of sec. 2, T. 79 N., R. 1 W.

Ap—0 to 9 inches; black (10YR 2/1) silt loam; weak fine granular structure; friable; medium acid; abrupt boundary.
A21—9 to 15 inches; dark gray (10YR 4/1) silt loam, gray (10YR 6/1) dry; few fine distinct strong brown (7.5YR 5/6) mottles; moderate fine platy structure; friable; continuous light gray (10YR 7/1, dry) silt coatings on faces of peds; medium acid; abrupt smooth boundary.
A22—15 to 18 inches; very dark gray (10YR 3/1) and dark gray (10YR 4/1) silt loam, gray (10YR 6/1) dry; common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium platy structure; friable; continuous light gray (10YR 7/1, dry) silt coatings on faces of peds; medium acid; gradual boundary.
B21tg—18 to 31 inches; very dark gray (10YR 3/1) light silty clay; common fine distinct yellowish brown (10YR 5/6) and light olive brown (2.5Y 5/4) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; firm; thin discontinuous gray (10YR 7/1, dry) silt coatings on faces of peds; thin discontinuous black (10YR 2/1) clay films on faces of peds; medium acid; gradual boundary.
B22tg—31 to 44 inches; gray (10YR 5/1) heavy silty clay loam; common fine distinct yellowish brown (10YR 5/6) and light olive brown (2.5Y 5/4) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; thin discontinuous clay films on faces of peds; slightly acid; gradual boundary.
B3tg—44 to 60 inches; olive gray (5Y 5/2) light silty clay loam; many fine and medium prominent strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure; firm; thick continuous very dark gray (10YR 3/1) clay films on faces of prisms; slightly acid; gradual boundary.
C—60 to 66 inches; olive gray (5Y 5/2) silt loam; common medium prominent strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure; friable; thick continuous black (10YR 2/1) clay films in root channels and along vertical cleavage lines; slightly acid.

The solum ranges from 48 to 68 inches in thickness. The A1 or Ap horizon is black (10YR 2/1) or very dark gray (10YR 3/1) and is 8 to 10 inches thick. The A2 horizon has hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 1 or 2. It is 6 to 12 inches thick. It has some mottles or concretions.

The B2t horizon has hue of 10YR to 5Y, value of 3 to 5, and chroma of 1 or 2. The high chroma mottles are few to many; they increase in number with increasing depth. The clay content in the Bt horizon generally ranges from 36 to 42 percent, but it is as much as 48 percent in some subhorizons less than 6 inches thick. The upper part of the B horizon is slightly acid or strongly acid.

Spillville series

The Spillville series consists of moderately well drained and somewhat poorly drained, moderately permeable soils that formed in loamy alluvium. These soils are on flood plains and along intermittent streams and drainageways. Slope ranges from 0 to 2 percent.

Spillville soils are similar to Hanlon soils and are commonly adjacent to Hanlon, Colo, and Nodaway soils on the landscape. Colo soils have a higher clay content than Spillville soils and are poorly drained. Hanlon soils

contain more sand and less clay in the A horizon than Spillville soils. Nodaway soils are lighter colored than Spillville soils, contain less sand, and are more stratified.

Typical pedon of Spillville loam, 0 to 2 percent slopes, 180 feet north and 1,180 feet east of the southwest corner of sec. 16, T. 81 N., R. 4 W.

A11—0 to 8 inches; very dark brown (10YR 2/2) loam; weak fine granular structure; friable; slightly acid; clear boundary.

A12—8 to 24 inches; black (10YR 2/1) light loam; weak fine subangular blocky structure; friable; medium acid; gradual boundary.

A13—24 to 34 inches; very dark brown (10YR 2/2) light loam; weak coarse subangular blocky structure; friable; slightly acid; gradual boundary.

AC—34 to 40 inches; very dark grayish brown (10YR 3/2) loam; weak coarse subangular blocky structure; very friable; slightly acid; gradual boundary.

C1—40 to 46 inches; dark grayish brown (10YR 4/2) sandy loam; massive; very friable; slightly acid; gradual boundary.

C2—46 to 60 inches; dark brown (10YR 4/3) loamy sand; massive; very friable; slightly acid.

The solum ranges from 30 to 56 inches in thickness. It is neutral to medium acid.

The A horizon typically is black (10YR 2/1) or very dark brown (10YR 2/2), but in places the lower part is very dark grayish brown (10YR 3/2) or very dark gray (10YR 3/1). These colors extend to a depth of 40 inches or more. The C horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 1 to 3. It is loam, sandy loam, or loamy sand.

Tama series

The Tama series consists of well drained, moderately permeable soils that formed in more than 40 inches of loess. These soils generally are on uplands, but in a few areas they are on loess-covered stream benches. Slope ranges from 0 to 14 percent.

Tama soils are similar to Fayette soils and are adjacent to Downs and Muscatine soils. Downs and Fayette soils have a thinner dark colored A horizon than Tama soils. Muscatine soils have a grayer B horizon than Tama soils and are more poorly drained.

Typical pedon of Tama silt loam, 2 to 5 percent slopes, 150 feet south and 1,270 feet west of the northeast corner of sec. 13, T. 79 N., R. 4 W.

Ap—0 to 6 inches; very dark brown (10YR 2/2) silt loam; weak fine granular structure; friable; slightly acid; abrupt boundary.

A12—6 to 13 inches; very dark brown (10YR 2/2) silty clay loam; moderate fine granular structure; friable; medium acid; gradual boundary.

B1—13 to 18 inches; dark brown (10YR 4/3) silty clay loam; very dark grayish brown (10YR 3/2) coatings on peds; weak fine subangular blocky structure; friable; strongly acid; gradual boundary.

B21t—18 to 28 inches; dark yellowish brown (10YR 4/4) silty clay loam; brown (10YR 4/3) coatings on peds; moderate fine subangular blocky structure; friable; few thin discontinuous clay films; medium acid; gradual boundary.

B22t—28 to 37 inches; yellowish brown (10YR 5/4) silty clay loam; dark yellowish brown (10YR 4/4) coatings on peds; moderate medium subangular blocky structure; friable; few thin discontinuous clay films; thin discontinuous light brownish gray (10YR 6/2, dry) silt coatings on faces of peds; medium acid; gradual boundary.

B3—37 to 45 inches; yellowish brown (10YR 5/4) light silty clay loam; few fine faint light brownish gray (10YR 6/2) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; few black oxides; thin discontinuous light brownish gray (10YR 6/2, dry) silt coatings on faces of peds; medium acid; gradual boundary.

C—45 to 60 inches; yellowish brown (10YR 5/4) heavy silt loam; common fine distinct light gray (10YR 7/2) and strong brown (7.5YR 5/6) mottles; massive; friable; few black concretions; neutral.

The solum ranges from about 36 to 60 inches in thickness. The A1 or Ap horizon is black (10YR 2/1) or very dark brown (10YR 2/2). The A horizon is 13 to 20 inches thick in uneroded areas. It is silt loam or silty clay loam. The B horizon has hue of 10YR, value of 3 to 5, and chroma of 3 to 6. It is medium acid to strongly acid. The B2t horizon ranges from 27 to 35 percent clay. Depth to grayish mottles ranges from about 30 to 50 inches.

Tama silt loam, 5 to 9 percent slopes, moderately eroded, and Tama silt loam, 9 to 14 percent slopes, moderately eroded, are outside the range defined for the Tama series because the A horizon does not qualify as a mollic epipedon. This difference, however, does not alter the use and behavior of the soils.

Tama Variant

The Tama Variant consists of moderately well drained, moderately permeable soils that formed in more than 40 inches of loess on uplands. These soils are on upland flats. Slope ranges from 1 to 3 percent.

Tama Variant soils are commonly adjacent to Downs, Muscatine, and other Tama soils on the landscape. Downs soils have a thinner dark colored A horizon than Tama Variant soils. Muscatine soils and the other Tama soils do not have thick light gray and white silt coatings on the faces of peds in the B horizon. Also, Muscatine soils are somewhat poorly drained.

Typical pedon of Tama Variant silt loam, 1 to 3 percent slopes, 300 feet east and 1,420 feet south of the northwest corner of sec. 22, T. 80 N., R. 1 W.

A1—0 to 11 inches; very dark brown (10YR 2/2) silt loam; weak fine granular structure; friable; strongly acid; clear boundary.
A3—11 to 15 inches; dark brown (10YR 3/3) heavy silt loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak medium platy structure parting to weak fine granular; friable; strongly acid; gradual boundary.
B1—15 to 22 inches; yellowish brown (10YR 5/4) light silty clay loam; dark brown (10YR 4/3) coatings on faces of peds; weak fine subangular blocky structure; friable; discontinuous light gray (10YR 7/1, dry) silt coatings on faces of peds; medium acid; gradual boundary.
B21t—22 to 28 inches; yellowish brown (10YR 5/6) silty clay loam; yellowish brown (10YR 5/4) coatings on faces of peds; moderate medium prismatic structure parting to moderate fine subangular blocky; thin discontinuous clay films; friable; discontinuous light gray (10YR 7/1, dry) silt coatings on faces of peds; medium acid; gradual boundary.
B22t—28 to 34 inches; yellowish brown (10YR 5/6) silty clay loam; light olive brown (2.5Y 5/6) coatings on faces of peds; moderate medium prismatic structure parting to moderate fine subangular blocky; friable; continuous white (N 8/1, dry) silt coatings on faces of peds; thin discontinuous clay films; medium acid; abrupt boundary.
B31—34 to 40 inches; grayish brown (10YR 5/2) light silty clay loam; many medium prominent yellowish red (5YR 5/6) and strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to weak medium subangular blocky; friable; nearly continuous white (N 8/1, dry) silt coatings on faces of peds; few thin discontinuous clay films; medium acid; gradual boundary.
B32—40 to 47 inches; mottled grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) heavy silt loam; weak coarse prismatic structure; friable; thin discontinuous clay films in root channels; thin discontinuous light gray (10YR 7/1, dry) silt coatings on faces of peds; medium acid; gradual boundary.
C—47 to 60 inches; mottled light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/6) heavy silt loam; weak very coarse prismatic structure; friable; discontinuous light gray (10YR 7/1, dry) silt coatings on vertical cleavage lines; numerous dark brown oxide concretions; medium acid.

The solum ranges from 40 to 70 inches in thickness. The most acid part of the solum is strongly acid. The A horizon is 10 to 16 inches thick. It has hue of 10YR and value and chroma of 2 or 3. The B horizon has hue of dominantly 10YR, value of 4 or 5, and chroma of 2 to 6. It ranges from 27 to 35 percent clay. Silt coatings are on the faces of peds in the B2 and B3 horizons. They have value of 7 or 8 and chroma of 1 or 2. The C horizon has value of 5 or 6 and chroma of 2 to 6.

Walford series

The Walford series consists of poorly drained, slowly permeable soils that formed in more than 40 inches of loess. These soils are on uplands or on stream benches. Slope is 0 to 1 percent.

Walford soils are similar to Atterberry soils and are commonly adjacent to Garwin, Muscatine, and Tama soils on the landscape. Atterberry soils are better drained than Walford soils. Garwin soils have a thicker A horizon than Walford soils and are more poorly drained. Muscatine soils are better drained than Walford soils and do not have an A2 horizon. Tama soils also are better drained and have a browner B horizon.

Typical pedon of Walford silt loam, 0 to 1 percent slopes, 75 feet west and 2,120 feet north of the southeast corner of sec. 27, T. 80 N., R. 1 W.

Ap—0 to 6 inches; very dark gray (10YR 3/1) silt loam; weak fine granular structure; friable; neutral; abrupt boundary.
A21—6 to 9 inches; dark grayish brown (10YR 4/2) silt loam; few fine distinct dark brown (7.5YR 3/2) mottles; weak fine platy structure; friable; slightly acid; clear boundary.
A22—9 to 15 inches; grayish brown (10YR 5/2) silt loam; few fine distinct dark brown (7.5YR 4/4) mottles; weak fine platy structure; friable; medium acid; clear boundary.
B1—15 to 22 inches; grayish brown (10YR 5/2) heavy silt loam; many fine prominent strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; friable; few dark reddish brown (5YR 3/2) concretions; medium acid; clear boundary.
B21—22 to 30 inches; light brownish gray (2.5Y 6/2) silty clay loam; many fine prominent strong brown (7.5YR 5/6) mottles; weak fine prismatic structure parting to moderate fine subangular blocky; firm; continuous light gray (10YR 7/2, dry) silt coatings on faces of peds; strongly acid; gradual boundary.
B22t—30 to 40 inches; grayish brown (2.5Y 5/2) heavy silty clay loam; many coarse prominent strong brown (7.5YR 5/6) mottles; moderate fine prismatic structure parting to moderate medium subangular blocky; firm; discontinuous clay films on faces of peds; common dark reddish brown (5YR 3/2) concretions; strongly acid; gradual boundary.
B23t—40 to 50 inches; mottled grayish brown (2.5Y 5/2) and strong brown (7.5YR 5/6) silty clay loam; weak medium prismatic structure; firm; discontinuous clay

films on faces of peds; strongly acid; gradual boundary.

B3—50 to 60 inches; mottled light brownish gray (2.5Y 6/2) and strong brown (7.5YR 5/6) light silty clay loam; weak coarse prismatic structure; firm; many dark reddish brown (5YR 3/2) concretions; strongly acid; gradual boundary.

C—60 to 65 inches; mottled light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/8) silt loam; massive; friable; medium acid.

The solum ranges from 50 to 70 inches in thickness. The A1 or Ap horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is 6 to 9 inches thick. The A2 horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is 8 to 14 inches thick.

The B2t horizon has hue of dominantly 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. The mottles have a higher chroma. The Bt horizon ranges from 32 to 38 percent clay; the weighted average is less than 35 percent. The B horizon is medium acid or strongly acid.

Waubeek series

The Waubeek series consists of moderately well drained and well drained, moderately permeable soils that formed in 24 to 40 inches of loess and in the underlying glacial till. These soils are on convex uplands. Slope ranges from 2 to 5 percent.

Waubeek soils are commonly adjacent to Dinsdale, Franklin, Klinger, and Maxfield soils on the landscape. Dinsdale soils have a thicker dark colored A horizon than Waubeek soils. Franklin, Maxfield, and Klinger soils have a grayer B horizon than Waubeek soils and are more poorly drained.

Typical pedon of Waubeek silt loam, 2 to 5 percent slopes, 820 feet south and 1,620 feet west of the northeast corner of sec. 23, T. 81 N., R. 4 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; friable; neutral; abrupt boundary.

A2—8 to 13 inches; dark grayish brown (10YR 4/2) silt loam; weak medium platy structure parting to weak fine subangular blocky; friable; slightly acid; clear boundary.

B1—13 to 21 inches; dark brown (10YR 4/3) light silty clay loam; moderate fine subangular blocky structure; friable; thin discontinuous light gray (10YR 7/2, dry) silt coatings on faces of peds; medium acid; gradual boundary.

B21—21 to 29 inches; yellowish brown (10YR 5/4) silty clay loam; dark brown (10YR 4/3) coatings on faces of peds; moderate medium subangular blocky structure; friable; few dark reddish brown (5YR 3/2) concretions; few thin discontinuous light gray (10YR 7/2, dry) silt coatings on faces of peds; medium acid; abrupt boundary.

IIB23t—29 to 33 inches; yellowish brown (10YR 5/6) heavy loam; yellowish brown (10YR 5/8) coatings on faces of peds; few medium faint grayish brown (10YR 5/2) mottles; moderate coarse prismatic structure; firm; few thin discontinuous clay films on faces of peds; common dark reddish brown (5YR 3/2) concretions; few small pebbles; light gray (10YR 7/2, dry) sand coatings on faces of peds; strongly acid; gradual boundary.

IIB3—33 to 46 inches; yellowish brown (10YR 5/6) heavy loam; yellowish brown (10YR 5/8) coatings on faces of peds; few fine faint gray (5Y 6/1) mottles; weak coarse prismatic structure; firm; few small pebbles; common dark reddish brown (5YR 3/2) concretions; neutral; abrupt boundary.

IIC—46 to 70 inches; yellowish brown (10YR 5/6) heavy loam; common medium distinct gray (5Y 6/1) mottles; massive; firm; few dark reddish brown (5YR 3/2) concretions; neutral.

The solum ranges from 42 to about 60 inches in thickness. The loess is 24 to 40 inches thick.

The A1 or Ap horizon is very dark brown (10YR 2/2), very dark grayish brown (10YR 3/2), or very dark gray (10YR 3/1). It is 6 to 9 inches thick. The A2 horizon is dark grayish brown (10YR 4/2) or brown (10YR 4/3 or 5/3). In some cultivated or eroded areas, it is incorporated into the Ap horizon.

The upper part of the B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. The lower part has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8, and it has a few to common low chroma mottles. It is dominantly neutral to medium acid. It is loam, sandy clay loam, or light clay loam. Lenses of sandy loam or loamy sand as much as 10 inches thick are between the loess and the glacial till in places.

Waukegan series

The Waukegan series consists of well drained soils that are moderately permeable in the upper part and rapidly permeable in the lower part. These soils formed in 30 to 45 inches of silty material and in the underlying loamy material. They are on stream benches and uplands. Slope ranges from 2 to 9 percent.

The Waukegan soils in this county are outside the limits defined as the range for the Waukegan series because they are slightly deeper to contrasting textures and because the transition layer of sandy loam is slightly thicker. These differences, however, do not alter the use or behavior of the soils.

Waukegan soils are similar to Whittier soils and are commonly adjacent to Richwood and Whittier soils on the landscape. Richwood soils are deeper to sand than

Waukegan soils. Whittier soils have a thinner dark colored A horizon than Waukegan soils.

Typical pedon of Waukegan silt loam, 5 to 9 percent slopes, 720 feet west and 1,160 feet north of the center of sec. 22, T. 81 N., R. 4 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) silt loam; weak fine granular structure; friable; neutral; abrupt boundary.

A12—7 to 12 inches; very dark brown (10YR 2/2) silt loam; weak fine granular structure; friable; neutral; clear boundary.

A3—12 to 18 inches; very dark brown (10YR 2/2) heavy silt loam, very dark grayish brown (10YR 3/2) crushed; weak fine subangular blocky structure; friable; neutral; clear boundary.

B21—18 to 25 inches; dark brown (10YR 4/3) light silty clay loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; moderate fine subangular blocky structure; friable; neutral; clear boundary.

B22t—25 to 31 inches; dark brown (10YR 4/3) light silty clay loam; moderate medium subangular blocky structure; friable; few thin discontinuous light gray (10YR 7/2, dry) silt coatings on faces of peds; few thin discontinuous clay films on faces of peds; medium acid; clear boundary.

B31—31 to 37 inches; dark yellowish brown (10YR 4/4) loam; weak fine subangular blocky structure; friable; medium acid; clear boundary.

IIB32—37 to 44 inches; dark yellowish brown (10YR 4/4) sandy loam; weak coarse subangular blocky structure; very friable; medium acid; clear boundary.

IIC—44 to 60 inches; yellowish brown (10YR 5/4) loamy sand and some fine gravel; single grain; loose; slightly acid.

The solum ranges from 42 to about 60 inches in thickness. The depth to contrasting textures ranges from about 30 to 45 inches.

The A1 or Ap horizon is black (10YR 2/1) or very dark brown (10YR 2/2), and the A3 horizon is very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2). The A horizon ranges from 12 to 20 inches in thickness. The B2 horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 6. The B2 and B31 horizons are loam, silty clay loam, or silt loam. The B horizon is neutral to strongly acid. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is loamy sand or sand that contains some fine gravel.

Whittier series

The Whittier series consists of well drained soils that are moderately permeable in the upper part and rapidly permeable in the substratum. These soils formed in about 24 to 40 inches of silty material and in the underlying sandy material. They are on stream benches and uplands. Slope ranges from 2 to 9 percent.

Whittier soils are similar to Waukegan soils and are commonly adjacent to Downs, Tama, and Waukegan soils on the landscape. Downs and Tama soils are not underlain by sandy material. Tama and Waukegan soils have a thicker dark colored A horizon than Whittier soils.

Typical pedon of Whittier silt loam, 2 to 5 percent slopes, 1,920 feet west and 300 feet south of the northeast corner of sec. 22, T. 81 N., R. 4 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; friable; neutral; abrupt boundary.

A2—7 to 9 inches; dark grayish brown (10YR 4/2) silt loam; dark brown (10YR 3/3) coatings on faces of peds; weak medium platy structure; friable; neutral; clear boundary.

B1—9 to 15 inches; dark yellowish brown (10YR 4/4) light silty clay loam; brown (10YR 4/3) coatings on faces of peds; weak fine subangular blocky structure; friable; few discontinuous light gray (10YR 7/2, dry) silt coatings on faces of peds; slightly acid; clear boundary.

B21—15 to 21 inches; dark yellowish brown (10YR 4/4) light silty clay loam; brown (10YR 4/3) coatings on faces of peds; weak fine subangular blocky structure; friable; few discontinuous light gray (10YR 7/2, dry) silt coatings on faces of peds; slightly acid; gradual boundary.

B22t—21 to 28 inches; yellowish brown (10YR 5/4) silty clay loam; brown (10YR 4/3) coatings on faces of peds; moderate fine subangular and angular blocky structure; friable; few discontinuous light gray (10YR 7/2, dry) silt coatings on faces of peds; few discontinuous clay films on faces of peds; slightly acid; clear boundary.

IIB3t—28 to 36 inches; yellowish brown (10YR 5/6) sandy clay loam; dark yellowish brown (10YR 4/4) coatings on faces of peds; weak coarse prismatic structure parting to weak fine and medium subangular blocky; friable; few discontinuous light gray (10YR 7/2, dry) silt coatings on faces of peds; few discontinuous clay films on faces of peds; strongly acid; clear boundary.

IIC—36 to 60 inches; yellowish brown (10YR 5/6) fine sand and sand; single grain; loose; few dark yellowish brown (10YR 4/4) clay-iron bands a quarter of an inch thick; strongly acid.

The thickness of the solum ranges from 30 to 48 inches. In places it corresponds to the depth to loamy sand or sand. The depth to sandy material is 30 to 40 inches in many areas but in places is only 24 inches.

The Ap or A1 horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is 6 to 9 inches thick. The A2 horizon is dark grayish brown (10YR 4/2)

or brown (10YR 4/3). It is about 2 to 5 inches thick. In some eroded areas it is incorporated into the Ap horizon. The B2 horizon has hue of 10YR, value of dominantly 4 or 5, and chroma of 3 or 4. The C horizon is fine sand, sand, or loamy sand.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*16*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 17, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Haplaquolls (*Hapl*, meaning simple horizons, plus *aquoll*, the suborder of Mollisols that have an aquic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Haplaquolls.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-silty, mixed, mesic Typic Haplaquolls.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Formation of the soils

The factors that have affected the formation of the soils in Cedar County are described in the following paragraphs.

Soil forms through by the action of soil-forming processes on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical compositon of the parent material; the climate under which the soil has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material (*4*). They are also influenced by human activities.

Climate and vegetation are the active factors in soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body with genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Time is needed for changing parent material into a soil. A long period generally is needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one unless conditions are specified for the others. Many of the processes of soil formation are unknown.

Parent material

The accumulation of parent material is the first step in the formation of a soil. Some of the soils in the county formed in material that remained in place after it weathered from bedrock. Most of the soils, however, formed in material transported from the site of the parent rock and redeposited through the action of glacial ice, water, wind, or gravity. The principal parent materials in Cedar County are loess, glacial drift, alluvium, and eolian, or wind-deposited, sand. Much less extensive parent materials are organic deposits and residuum.

Loess is the most important parent material in the county. It is wind-blown silt that mantles glacial drift. It was deposited during the Wisconsin age. Unweathered loess is calcareous silt loam. The loess varies in thickness. In some areas, no loess mantles the glacial till or it is only 20 to 40 inches deep over the till. In the rest of the county, it ranges from 9 to 32 feet in thickness.

The loess-mantled areas north and east of the Cedar River have been divided into four categories—1. loess-mantled Cleona Channel, 2. thick loess-mantled Iowan surface, 3. loess-mantled Iowan surface, and 4. thick loess-mantled Yarmouth-Sangamon surface (*6*).

The first area, which is just north of Durant, is the loess-mantled Cleona Channel and the loess-mantled Lake Calvin terraces or benches. The Cleona Channel is a preglacial valley that extends from the mouth of the Wapsipinicon River southwest across Scott, Cedar, and Muscatine Counties. This channel has been filled with 200 to 300 feet of unconsolidated sediment. It extends across the southeast corner of Cedar County.

The second area is the thick loess-mantled Iowan surface, where the loess is 9 to 18 feet deep over a truncated glacial till surface (*13*). An example is the "Sunbury Flats," in the eastern part of the county. This plain has a swell-swale topography (fig. 16). The common landscape features are a convex knob, a linear back slope 1,000 feet or more long, a slope of 1 to 3 percent, and a concave depression at the base of the slope. Dissection by streams is minimal.

Figure 16.—The swell-swale topography in a locally ponded area of the "Sunbury Flats."

In some of the soils that formed on the "Sunbury Flats," sand is between the loess and the glacial till. In these areas well drained or moderately well drained soils are on swells. If no sand is between the loess and the glacial till, somewhat poorly drained and poorly drained soils are in swales.

The soils on the "Sunbury Flats" have thick, gray, grainy coatings on the faces of peds. These coatings are not so common in the rest of the soils on the thick loess-mantled Iowan surface. The Sunbury area may have been either an isolated forest island in the middle of the prairie region or within that part of eastern Iowa where forest vegetation was dominant during part of the Holocene period but where soils having properties characteristic of forest soils were removed by erosion on hillsides and secondary and tertiary interfluves (*3*).

The Tama Variant and Atterberry and Muscatine soils are examples of soils on the "Sunbury Flats." Downs, Tama, and Muscatine are examples of soils that formed on the thick loess-mantled Iowan surface but are not on the "Sunbury Flats." Lindley soils formed in areas where Kansan till is exposed on the steeper slopes.

The third area is the loess-mantled Iowan surface, where the loess is less than 7 feet thick. In places there is no loess or only 20 to 40 inches of loess. In this area the landscape was eroded down to Kansan and older drifts. It is called the Iowan erosion surface complex (*11*). Dinsdale, Klinger, Maxfield, and Waubeek soils are dominant in this area.

The fourth area is the thick loess-mantled Yarmouth-Sangamon surface. The highest surface, it is on stable upland summits. The loess is 16 feet or more thick on the broader ridges and as much as 32 feet thick where it abuts the Iowan erosion surface (*8, 13*). This area and the areas south of the Cedar River were once considered parts of the Kansan drift plain but are now designated as areas of Wisconsin loess on the Yarmouth-Sangamon paleosol on Kansan till (*8*) (fig. 17).

Figure 17.—The Yarmouth-Sangamon paleosol exposed by a cut on Kansan till.

Figure 18.—Contour stripcropping on a long "paha" ridge.

Downs, Fayette, and Tama soils formed in this area. In places the paleosol is exposed. In the steeper areas, glacial till is exposed and Lindley soils formed.

Scattered throughout the county are long ridges called "pahas" (*11, 12*). These loess-capped ridges, which are oriented northwest to southeast, stand apart on the Iowan plain or, along with landforms having similar features, form long ridges or broad plateaus (fig. 18).

Glacial drift is rock material transported by glacial ice, material deposited by glacial ice, and deposits of dominantly glacial origin made in the sea or in bodies of glacial melt water. It includes glacial till. Glacial till is an unsorted sediment ranging in size from boulders to clay (*8*). Glacial drift is the second most important parent material of the soils in Cedar County. At least twice during the glacial period continental ice or glaciers moved over the land. The record of these ice invasions is contained in the unconsolidated rock material that was deposited by the melting ice and melt water streams. The older ice sheet, known as the Nebraskan, occurred some 750,000 years ago (*5*). It was followed by the Aftonian interglacial period. The Kansan glaciation is thought to have started about 500,000 years ago.

Much of the landscape in Cedar County is a multilevel sequence of erosion surfaces. Many of the levels are cut into Kansan and Nebraskan till. The multilevel Iowan erosion surface is arranged in a series of steps from the major drainageways toward bounding divides. It is marked by a stone line where it cuts through Kansan and Nebraskan till. The stone line occurs on all levels of the stepped surfaces, and it passes under the alluvium along the drainageways.

Bassett and Kenyon soils formed in glacial drift and glacial till on the Iowan erosion surface. They have loamy surficial sediment about 1 foot to 2 feet deep over glacial material. A stone line or pebble band commonly separates the friable loamy sediment from the firm loam or clay loam glacial till.

Alluvium consists of sediment transported and deposited by water. These alluvial deposits of Late Wisconsin age are on the flood plains and terraces along watercourses in Cedar County. They consist of lenses and layers of sand, gravel, silt, and clay. This alluvial material varies in thickness. Along the major streams it is very thick, but along the smaller streams it is less than 5 feet thick. Saude soils formed in loamy alluvium over sand and gravel, and Richwood soils formed in silty material that contains some stratified sand below a depth of 4 feet.

Some alluvial material has accumulated at the foot of the slope on which it originated. This material, called local alluvium, retains many characteristics of the soils in the areas from which it has eroded. Judson soils are examples. They are at the foot of the slopes directly below loess-derived soils.

When streams overflow their channels and water spreads over the flood plains, the coarse textured material is deposited first. Fine textured sediment, such as silt, is deposited when the floodwater moves more slowly. After the floodwater has receded, the finest particles, or clay, settle from the water left standing on the lowest part of the flood plain. Kennebec and Nodaway soils formed in silty material, and Spillville soils formed in coarser textured loamy material. Colo and Sawmill soils, which are on the lowest part of the flood plain, have a

solum of silty clay loam and contain more clay than the soils on the higher parts of the flood plain.

In the southern part of the county, an old glacial lake, Pleistocene Lake Calvin, probably occupied the extensive lowland near the confluence of the Iowa and Cedar Rivers (fig. 19). It covered parts of what are now Cedar, Johnson, Louisa, Muscatine, Scott, and Washington Counties. This basin is surrounded by glacial drift uplands. It has three distinct surfaces, identified as "high," "intermediate," and "low" terraces. These terraces were formed when material was transported from the Iowan erosion surface. They are not related to lake features but are river terraces of a down valley geomorphic system (*9*).

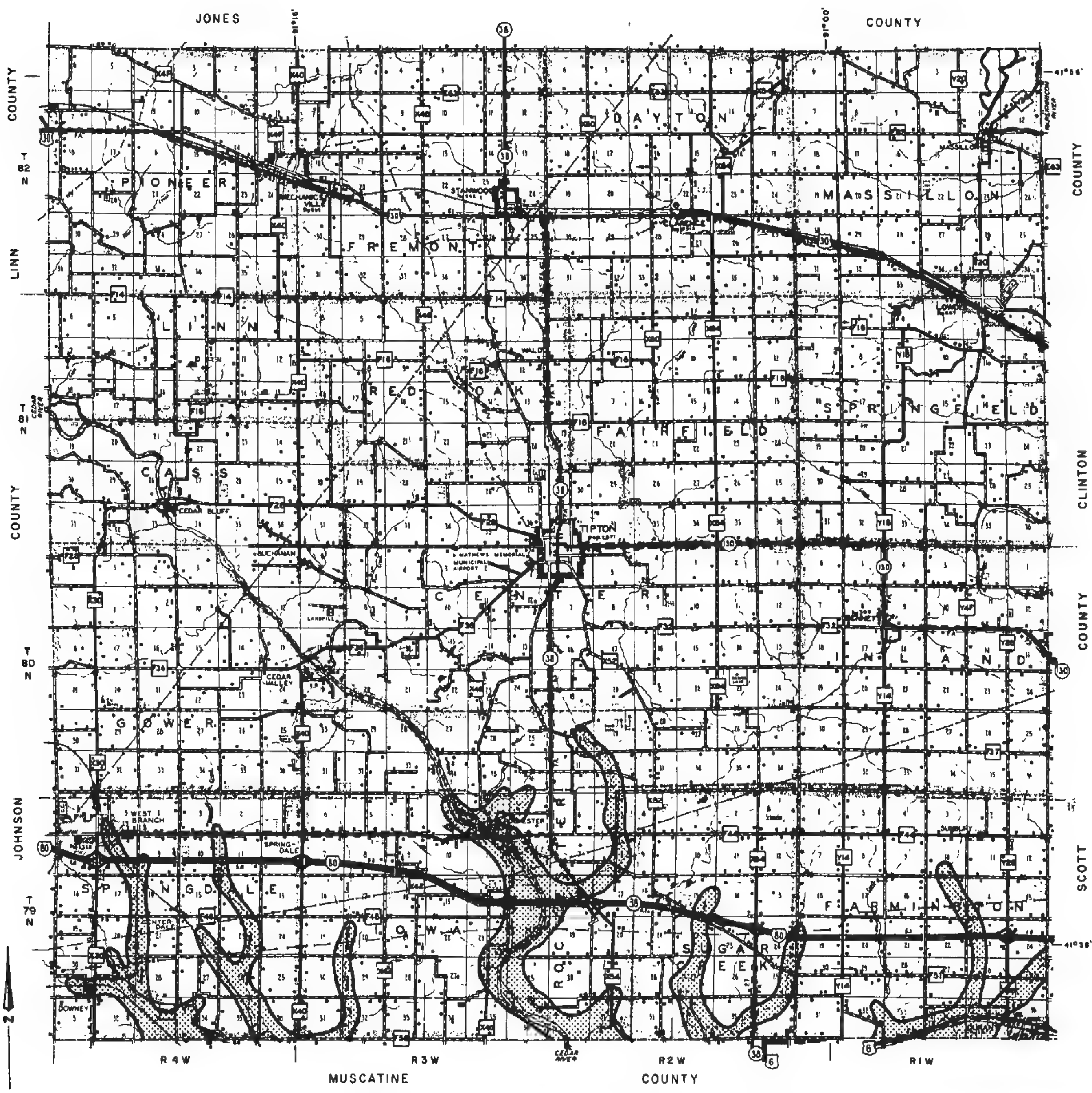


Figure 19.—General location of Pleistocene Lake Calvin in Cedar County (shaded area).

On the maps at the back of this report, the soils on the landscape once occupied by Lake Calvin were not mapped as bench map units because the benches blend in well with the upland landscape in all areas but those along Cedar River and part of Sugar Creek.

Eolian, or wind-deposited, sand is in the uplands and on benches. In the glacial uplands, it occurs as low mounds or dunes and is underlain by till at varying depths. The sand also occurs as areas intermingled with loess soils. It is largely quartz, which is fine or very fine in size and is highly resistant to weathering. It has not been altered appreciably since it was deposited. Chelsea, Dickinson, Lamont, and Sparta soils formed mainly in wind-deposited sand.

Organic deposits of plant material accumulated in old lakebeds or swamps that supported a thick growth of water-tolerant plants. The organic soils in this county are in small wet areas where poor drainage has retarded the decay of plant remains. In most areas the organic material ranges from about 10 to 60 inches in thickness, but in a few areas it is more than 60 inches thick. Palms muck formed in organic material.

Residuum is material derived from sedimentary rock that weathered in place. It is a very minor parent material in this county. The underlying bedrock for three-fourths of the county is Silurian. That for the other fourth, which is in the southwestern part, is Devonian. These two systems are made up principally of limestone, dolomite, and a small amount of shale. A very small area of the Pennsylvanian system is near Sunbury. This system has layers of shale, clay, siltstone, sandstone, and limestone and thick coal beds. None of these systems are level. They generally slope to the southwest about 20 feet per mile.

Climate

The soils in Cedar County have been forming under the influence of a midcontinental, subhumid climate for at least 5,000 years. Between 5,000 and 16,000 years ago, the climate was conducive to the growth of forest vegetation (*7*). The morphology of most of the soils indicates that the climate under which the soils formed is similar to the present one. The present climate generally is uniform throughout the county but is marked by wide seasonal extremes in temperature.

Climate is a major factor in determining what soils form in the various parent materials. The rate and intensity of hydrolysis, carbonation, oxidation, and other important chemical reactions are influenced by climate. Temperature, rainfall, relative humidity, and length of the frost-free period are important in determining the kind of vegetation.

The influence of the climate of the region is somewhat modified by the local conditions in or near the soil. On south-facing, dry, sandy slopes, for example, the temperature is higher and the humidity lower than is typical in nearby areas. In low, poorly drained areas, the soils are wetter and the temperature lower than is typical in most of the surrounding areas. These local conditions account for some of the differences among the soils in the county.

Plant and animal life

Living organisms are important in soil formation. These include vegetation, animals, bacteria, and fungi. The vegetation helps to determine the content of organic matter, the color of the surface layer, and the content of nutrients. Earthworms and other burrowing animals help to keep the soil open and porous. Bacteria and fungi decompose the vegetation and thereby release nutrients for plant food.

Most of the soils in Cedar County formed under prairie grasses or a mixture of prairie grasses and water-tolerant plants. Many decayed roots and tops of grasses are on or in the soils. As a result, the surface layer is thick and dark. Muscatine and Tama soils are examples.

The soils that formed under trees have a thinner, lighter colored surface layer. The organic matter, derived principally from leaves, was deposited on the surface of the soil. Fayette and Lindley soils are examples.

Many soils first formed under prairie grasses and then under trees. These soils are intermediate between those soils that formed only under grass and those that formed only under trees. Downs and Waubeek soils are examples.

Downs, Fayette, and Tama soils formed in the same parent material and, except for the native vegetation, under similar conditions. Differences in native vegetation account for the main morphological differences among these soils.

Relief

Relief influences soil formation mainly through its effect on drainage, runoff, and erosion. In Cedar County the relief ranges from level to very steep. Water soaks into the level and nearly level soils in areas that are not flooded. Where the slope is steeper, more water runs off and less penetrates the soil.

Dinsdale, Klinger, and Maxfield soils, which formed in the same kind of parent material and under similar vegetation, differ from one another because of relief and position on the landscape. The gently sloping and moderately sloping Dinsdale soils are on uplands. The nearly level Klinger soils are on ridges and long, gentle, concave slopes. The level or nearly level Maxfield soils are on broad, high upland flats.

In depressions that collect and impound water, the soils are poorly drained and have a distinct, light colored subsurface layer and a gray subsoil. Sperry soils, for example, formed in depressions.

Steeply sloping soils show little evidence of soil formation. Most of the precipitation runs off. Sogn soils are examples.

Soils that formed in alluvium, such as Colo, Kennebec, and Spillville soils, are on bottom land. The microrelief of these nearly level soils affects the runoff rate, depth to the water table, and the amount of new sediment that is added. Colo soils, which are at a low elevation, are poorly drained, have a high water table, and impound water for short periods. Kennebec and Spillville soils are at a slightly higher elevation. Kennebec soils are moderately well drained, and Spillville soils are moderately well drained and somewhat poorly drained.

Aspect has a significant effect on soil formation. South-facing slopes generally are warmer and drier than north-facing slopes. As a result, they support a different kind and amount of vegetation.

The influence of a porous, rapidly permeable parent material can override the influence of relief. Even though they are nearly level to moderately steep, Sparta soils, for example, are excessively drained because they are very rapidly permeable.

Time

The length of time that soil material remains in place and is acted on by the soil-forming processes affects the kind of soil that forms. The older soils have the more strongly expressed genetic horizons. Downs, Fayette, and Tama soils are examples.

A less well developed soil has only weakly expressed horizons. Some soils that formed in alluvium show little or no evidence of soil formation because fresh material is deposited periodically. They have not been in place long enough for the climate and vegetation to produce well defined genetic horizons. Nodaway soils are very young. In the steeper areas where soil material is removed, a deep soil cannot form. Sogn soils are examples.

The resistance of soil material to weathering can modify the effect of time. Soils that formed in material resistant to weathering, such as quartz sand, do not change much with time. Chelsea and Sparta soils are examples.

In areas where buried organic material has been deposited by ice, water, or wind, the age of a landscape can be determined by a process called radiocarbon dating (*10*).

The loess in which Downs, Fayette, and Tama soils formed is probably 14,000 to 20,000 years old. A part of the Iowan erosion surface formed when the loess was deposited (*11*). The Iowan surface beneath the loess could be 14,000 years old, an age which dates back to the end of the major loess deposition in Iowa. The surface not covered by loess is younger than the loess. In areas where it is covered by loam sediments, it is less than 14,000 years old and the soils on the slopes are probably much younger. Bassett, Kenyon, and other soils are on this surface.

Human activities

Important changes took place after Cedar County was settled. Some had little effect on soil productivity, and others had drastic effects.

Changes caused by water erosion are the most important. In sloping areas cultivation increases the susceptibility to erosion, which removes topsoil, organic matter, and plant nutrients. Sheet erosion, which is the most prevalent kind of erosion in the county, removes a few inches of topsoil at a time, but cultivation generally destroys all evidence of this loss. In some areas shallow and deep gullies have formed. The eroded material has been deposited on the lower slopes.

Soil blowing also occurs after the soil is cultivated. Light textured soils are highly susceptible to soil blowing, especially if the surface is bare and the topsoil is dry. After nearly level fields are plowed in the fall, dark topsoil is mixed with snow or piled along fence rows and road ditches.

In fields that are cultivated year after year, the well developed granular structure of the surface layer, so apparent in virgin grassland, begins to break down. The surface layer generally is baked and hard when dry. The fine textured soils that are plowed when wet tend to puddle and are less permeable than similar soils in undisturbed areas.

In some fields a compact layer that hardens on drying and is less permeable than the subsoil forms below the plow layer. This layer is called a plowsole or plowpan.

In Cedar County, Arenzville silt loam shows the influence of cultivation. Strata of light and dark colored material that washed from hillsides and was deposited by floods overlie the original dark colored soil. This erosion began to occur after the hillsides were cultivated.

Management practices have increased the productivity of some areas and reclaimed areas that otherwise are not suitable for crops. Drainage ditches and diversions at the foot of slopes help to prevent flooding on lowlands. As a result, the lowlands can be used for cultivated crops. Additions of commercial fertilizer counteract deficiencies in plant nutrients so that the soil can be more productive. In many places dark colored, low lying soils have received deposits of lighter colored soil material.

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Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex, soil. A map unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Fast intake. The rapid movement of water into the soil.

Favorable. Favorable soil features for the specified use.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May,* for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Frost action. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the assorted and unassorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by melt water as it flows from glacial ice.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Gleyed soil. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. Inadequate strength for supporting loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is greater than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured (moderately heavy textured) soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse* more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material mixed with mineral soil material. The content of organic matter is more than 20 percent.

Munsell notation. A designation of color by degrees of the three single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the basis of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differences are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water forms subsurface tunnels or pipelike cavities in the soil.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average

height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stone line. A concentration of coarse fragments in soils that generally marks an old weathering surface. In a cross section, the line may be one fragment or more thick. The line generally overlies material that weathered in place and marks the top of a paleosol. It is ordinarily overlain by recent sediment of variable thickness.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protection from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use or management.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION

Month	Temperature*						Precipitation*				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days**	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	28.7	9.9	19.4	56	-20	0	1.30	.44	1.97	3	6.5
February---	34.5	15.3	24.9	57	-14	0	1.30	.45	1.98	3	6.6
March------	45.5	25.2	35.4	76	-1	21	2.50	1.27	3.50	6	6.1
April------	61.9	38.2	50.1	86	19	100	4.01	2.60	5.29	7	.8
May--------	73.0	49.0	61.0	92	30	353	4.74	2.62	6.47	8	.0
June-------	82.4	59.0	70.7	96	42	621	4.65	2.69	6.24	7	.0
July-------	85.9	62.8	74.4	98	48	756	4.65	2.74	6.35	7	.0
August-----	84.1	60.4	72.2	96	45	688	3.88	1.85	5.52	6	.0
September--	76.6	52.1	64.3	95	32	429	3.98	1.74	5.79	6	.0
October----	66.3	41.5	53.9	88	22	199	2.85	.82	4.46	5	.2
November---	48.8	29.1	39.0	74	4	8	2.33	.96	3.43	4	1.9
December---	34.2	17.1	25.7	61	-15	0	2.02	.90	2.92	5	8.9
Year-----	60.2	38.3	49.3	99	-20	3,175	38.21	30.84	45.18	67	31.0

* Recorded in the period 1952-74 at Tipton, Iowa.

** A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Temperature*		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 21	April 25	May 16
2 years in 10 later than--	April 16	April 21	May 11
5 years in 10 later than--	April 7	April 13	April 30
First freezing temperature in fall:			
1 year in 10 earlier than--	October 16	October 7	September 23
2 years in 10 earlier than--	October 21	October 12	September 28
5 years in 10 earlier than--	October 31	October 21	October 8

* Recorded in the period 1952-74 at Tipton, Iowa.

TABLE 3.--GROWING SEASON

Probability	Daily minimum temperature during growing season*		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	190	172	139
8 years in 10	195	178	146
5 years in 10	207	190	160
2 years in 10	218	202	174
1 year in 10	223	208	181

* Recorded in the period 1952-74 at Tipton, Iowa.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
8B	Judson silt loam, 2 to 5 percent slopes	1,825	0.5
11B	Colo-Ely complex, 2 to 5 percent slopes	30,300	8.0
41B	Sparta loamy fine sand, 1 to 5 percent slopes	915	0.2
41C	Sparta loamy fine sand, 5 to 9 percent slopes	605	0.2
41E	Sparta loamy fine sand, 9 to 18 percent slopes	285	0.1
63B	Chelsea loamy fine sand, 2 to 5 percent slopes	540	0.1
63C	Chelsea loamy fine sand, 5 to 9 percent slopes	1,160	0.3
63E	Chelsea loamy fine sand, 9 to 20 percent slopes	1,470	0.4
65D2	Lindley loam, 9 to 14 percent slopes, moderately eroded	645	0.2
65E2	Lindley loam, 14 to 18 percent slopes, moderately eroded	1,300	0.3
65F2	Lindley loam, 18 to 25 percent slopes, moderately eroded	500	0.1
83B	Kenyon loam, 2 to 5 percent slopes	1,695	0.5
83C	Kenyon loam, 5 to 9 percent slopes	660	0.2
83C2	Kenyon loam, 5 to 9 percent slopes, moderately eroded	1,020	0.3
88	Nevin silty clay loam, 0 to 2 percent slopes	940	0.3
110C	Lamont fine sandy loam, 2 to 9 percent slopes	440	0.1
110E	Lamont fine sandy loam, 9 to 18 percent slopes	455	0.1
118	Garwin silty clay loam, 0 to 2 percent slopes	6,495	1.7
119	Muscatine silt loam, 0 to 2 percent slopes	14,190	3.8
119B	Muscatine silt loam, 2 to 5 percent slopes	5,665	1.5
120	Tama silt loam, 0 to 2 percent slopes	465	0.1
120B	Tama silt loam, 2 to 5 percent slopes	52,260	13.9
120C	Tama silt loam, 5 to 9 percent slopes	7,355	2.0
120C2	Tama silt loam, 5 to 9 percent slopes, moderately eroded	21,410	5.6
120D2	Tama silt loam, 9 to 14 percent slopes, moderately eroded	2,290	0.6
121	Tama Variant silt loam, 1 to 3 percent slopes	1,330	0.4
122	Sperry silt loam, 0 to 1 percent slopes	280	0.1
133	Colo silty clay loam, 0 to 2 percent slopes	5,345	1.4
133+	Colo silt loam, overwash, 0 to 2 percent slopes	5,300	1.4
143	Brady sandy loam, 0 to 2 percent slopes	500	0.1
160	Walford silt loam, 0 to 1 percent slopes	1,790	0.5
162B	Downs silt loam, 2 to 5 percent slopes	11,105	3.0
162C	Downs silt loam, 5 to 9 percent slopes	1,535	0.4
162C2	Downs silt loam, 5 to 9 percent slopes, moderately eroded	18,245	4.9
162D2	Downs silt loam, 9 to 14 percent slopes, moderately eroded	11,760	3.1
163B	Fayette silt loam, 2 to 5 percent slopes	5,665	1.5
163C	Fayette silt loam, 5 to 9 percent slopes	2,850	0.8
163C2	Fayette silt loam, 5 to 9 percent slopes, moderately eroded	15,370	4.1
163D	Fayette silt loam, 9 to 14 percent slopes	2,600	0.7
163D2	Fayette silt loam, 9 to 14 percent slopes, moderately eroded	8,900	2.4
163D3	Fayette silty clay loam, 9 to 14 percent slopes, severely eroded	9,480	2.5
163E	Fayette silt loam, 14 to 18 percent slopes	1,850	0.5
163E3	Fayette silty clay loam, 14 to 18 percent slopes, severely eroded	10,090	2.7
163F	Fayette silt loam, 18 to 25 percent slopes	3,515	0.9
163F2	Fayette silt loam, 18 to 25 percent slopes, moderately eroded	5,155	1.4
163G	Fayette silt loam, 25 to 40 percent slopes	1,355	0.4
171B	Bassett loam, 2 to 5 percent slopes	345	0.1
171C2	Bassett loam, 5 to 9 percent slopes, moderately eroded	1,515	0.4
171D2	Bassett loam, 9 to 14 percent slopes, moderately eroded	630	0.2
175B	Dickinson fine sandy loam, 1 to 5 percent slopes	915	0.2
175C	Dickinson fine sandy loam, 5 to 9 percent slopes	660	0.2
177	Saude loam, 1 to 3 percent slopes	1,020	0.3
184	Klinger silt loam, 1 to 3 percent slopes	9,620	2.6
212	Kennebec silt loam, 0 to 2 percent slopes	1,360	0.4
214D	Rockton loam, 20 to 30 inches to limestone, 5 to 14 percent slopes	1,135	0.3
220	Nodaway silt loam, 0 to 2 percent slopes	1,330	0.4
221	Palms muck, 1 to 3 percent slopes	220	0.1
291	Atterberry silt loam, 0 to 2 percent slopes	10,755	2.9
291B	Atterberry silt loam, 2 to 5 percent slopes	2,630	0.7
293C	Chelsea-Lamont-Fayette complex, 5 to 9 percent slopes	510	0.1
293E	Chelsea-Lamont-Fayette complex, 9 to 18 percent slopes	1,095	0.3
293F	Chelsea-Lamont-Fayette complex, 18 to 40 percent slopes	410	0.1
315	Loamy alluvial land-Spillville complex, 0 to 2 percent slopes	4,500	1.2
320	Arenzville silt loam, 0 to 2 percent slopes	1,050	0.3
350B	Waukegan silt loam, 2 to 5 percent slopes	1,380	0.4
350C	Waukegan silt loam, 5 to 9 percent slopes	290	0.1
352B	Whittier silt loam, 2 to 5 percent slopes	470	0.1
352C2	Whittier silt loam, 5 to 9 percent slopes, moderately eroded	440	0.1
354	Marsh	250	0.1
377B	Dinsdale silt loam, 2 to 5 percent slopes	12,525	3.3
377C	Dinsdale silt loam, 5 to 9 percent slopes	955	0.3
377C2	Dinsdale silt loam, 5 to 9 percent slopes, moderately eroded	1,410	0.4

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
382	Maxfield silty clay loam, 0 to 2 percent slopes	3,575	1.0
412E	Sogn loam, 9 to 18 percent slopes	490	0.1
420B	Tama silt loam, benches, 2 to 5 percent slopes	700	0.2
428B	Ely silt loam, 2 to 5 percent slopes	1,245	0.3
442C	Dickinson-Tama complex, 4 to 10 percent slopes	285	0.1
462B	Downs silt loam, benches, 2 to 5 percent slopes	395	0.1
463B	Fayette silt loam, benches, 2 to 5 percent slopes	435	0.1
467	Radford silt loam, 0 to 2 percent slopes	1,640	0.4
478G	Rock outcrop-Sogn complex, 25 to 60 percent slopes	1,160	0.3
485	Spillville loam, 0 to 2 percent slopes	2,370	0.6
536	Hanlon fine sandy loam, 0 to 2 percent slopes	790	0.2
729B	Nodaway-Arenzville silt loams, 2 to 5 percent slopes	3,670	1.0
760	Ansgar silt loam, 0 to 2 percent slopes	985	0.3
761	Franklin silt loam, 1 to 3 percent slopes	4,870	1.3
771B	Waubeek silt loam, 2 to 5 percent slopes	1,895	0.5
933	Sawmill silty clay loam, 0 to 2 percent slopes	7,310	2.0
977	Richwood silt loam, 0 to 2 percent slopes	345	0.1
1119	Muscatine silt loam, benches, 0 to 2 percent slopes	395	0.1
1133	Colo silty clay loam, channeled, 0 to 2 percent slopes	445	0.1
1160	Walford silt loam, benches, 0 to 1 percent slopes	425	0.1
1220	Nodaway silt loam, channeled, 0 to 2 percent slopes	1,680	0.4
1291	Atterberry silt loam, benches, 0 to 2 percent slopes	730	0.2
	Quarries, sand pits, borrow areas, and made land	370	0.1
	Water	1,870	0.5
	Total	374,400	100.0

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[All yields were estimated for a high level of management. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Corn	Soybeans	Oats	Grass-legume hay	Bromegrass-alfalfa	Kentucky bluegrass
	Bu	Bu	Bu	Ton	AUM*	AUM*
8B----------------------- Judson	124	47	93	5.2	8.3	4.2
11B---------------------- Colo-Ely	105	40	81	4.3	7.3	4.2
41B---------------------- Sparta	63	24	47	2.5	4.1	2.0
41C---------------------- Sparta	56	21	42	2.3	3.8	2.0
41E---------------------- Sparta	---	---	---	2.0	3.3	1.4
63B---------------------- Chelsea	57	21	42	2.0	3.3	2.0
63C---------------------- Chelsea	52	20	39	1.8	3.0	1.8
63E---------------------- Chelsea	---	---	---	1.3	2.1	1.1
65D2--------------------- Lindley	69	26	38	2.9	4.8	2.3
65E2--------------------- Lindley	---	---	---	1.5	2.5	2.0
65F2--------------------- Lindley	---	---	---	1.0	1.6	1.4
83B---------------------- Kenyon	113	43	90	4.7	7.8	4.2
83C---------------------- Kenyon	108	41	86	4.5	7.5	4.0
83C2--------------------- Kenyon	105	40	84	4.4	7.3	3.8
88----------------------- Nevin	114	43	85	4.8	8.0	4.0
110C--------------------- Lamont	64	24	48	2.3	3.8	2.1
110E--------------------- Lamont	---	---	36	1.0	1.6	1.3
118---------------------- Garwin	125	47	94	5.0	8.3	4.1
119---------------------- Muscatine	131	50	98	5.5	9.1	4.2
119B--------------------- Muscatine	129	49	96	5.5	9.1	4.2
120---------------------- Tama	127	49	95	5.3	8.6	4.2

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Grass-legume hay	Bromegrass-alfalfa	Kentucky bluegrass
	Bu	Bu	Bu	Ton	AUM*	AUM*
120B-------------------- Tama	125	48	95	5.2	8.6	4.2
120C-------------------- Tama	120	46	90	5.0	8.3	4.0
120C2------------------- Tama	117	44	88	4.9	8.1	3.8
120D2------------------- Tama	108	41	81	4.5	7.5	3.3
121--------------------- Tama Variant	127	48	95	5.2	8.6	4.1
122--------------------- Sperry	97	37	73	3.5	5.8	3.6
133--------------------- Colo	104	40	88	4.2	7.0	4.2
133+-------------------- Colo	109	42	85	4.3	7.0	4.2
143--------------------- Brady	90	34	72	3.8	6.3	3.6
160--------------------- Walford	99	38	75	3.5	5.8	3.0
162B-------------------- Downs	119	45	95	5.0	8.3	4.1
162C-------------------- Downs	114	43	91	4.8	8.1	4.0
162C2------------------- Downs	111	42	89	4.7	7.8	3.8
162D2------------------- Downs	102	39	82	4.3	7.1	3.6
163B-------------------- Fayette	113	43	90	4.7	7.8	4.0
163C-------------------- Fayette	108	41	86	4.5	7.5	3.8
163C2------------------- Fayette	105	40	84	4.4	7.3	3.7
163D-------------------- Fayette	99	38	80	4.2	7.0	3.6
163D2------------------- Fayette	96	36	76	4.0	6.6	3.6
163D3------------------- Fayette	90	34	72	3.8	6.3	3.5
163E-------------------- Fayette	84	32	67	3.5	5.8	3.3
163E3------------------- Fayette	---	---	62	3.2	5.3	3.0

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Grass-legume hay	Bromegrass-alfalfa	Kentucky bluegrass
	Bu	Bu	Bu	Ton	AUM*	AUM*
163F, 163F2 Fayette	---	---	60	3.4	5.6	3.1
163G Fayette	---	---	---	3.0	5.0	3.0
171B Bassett	107	40	85	4.5	7.5	4.0
171C2 Bassett	99	38	80	4.0	6.6	3.5
171D2 Bassett	90	34	72	3.8	6.3	3.2
175B Dickinson	81	31	60	3.0	5.0	2.7
175C Dickinson	76	29	57	2.8	4.6	2.5
177 Saude	76	29	61	3.2	5.3	3.0
184 Klinger	123	46	92	5.1	8.5	4.2
212** Kennebec	121	46	91	5.1	8.5	4.2
214D Rockton	62	24	49	2.5	4.1	2.1
220 Nodaway	110	42	60	4.6	7.6	4.0
221 Palms	80	30	65	3.2	5.3	3.3
291 Atterberry	125	47	93	5.0	8.3	4.0
291B Atterberry	123	46	92	5.0	8.3	4.0
293C Chelsea-Lamont-Fayette	72	27	56	2.8	4.6	2.4
293E Chelsea-Lamont-Fayette	---	---	50	2.4	4.0	2.2
293F. Chelsea-Lamont-Fayette						
315 Loamy alluvial land-Spillville	---	---	---	---	---	2.6
320 Arenzville	106	40	85	4.5	7.5	4.0
350B Waukegan	87	33	70	3.7	6.1	3.3
350C Waukegan	82	31	66	3.4	5.6	3.1

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Grass-legume hay	Bromegrass-alfalfa	Kentucky bluegrass
	Bu	Bu	Bu	Ton	AUM*	AUM*
352B-----Whittier	83	31	67	3.5	5.8	3.3
352C2-----Whittier	75	29	60	3.2	5.3	2.8
354***. Marsh						
377B-----Dinsdale	119	45	89	5.0	8.3	4.1
377C-----Dinsdale	114	43	85	4.8	8.0	4.0
377C2-----Dinsdale	111	42	83	4.6	7.6	3.8
382-----Maxfield	119	45	89	5.0	8.3	4.2
412E-----Sogn	---	---	---	---	---	1.1
420B-----Tama	125	48	95	5.2	8.6	4.2
428B-----Ely	124	47	93	5.3	8.8	4.0
442C-----Dickinson-Tama	94	35	70	3.7	6.1	3.1
462B-----Downs	119	45	95	5.0	8.3	4.1
463B-----Fayette	113	43	90	4.7	7.8	4.0
467-----Radford	106	40	80	5.0	8.5	3.8
478G***: Rock outcrop.						
Sogn-----	---	---	---	---	---	1.1
485-----Spillville	122	46	98	5.1	8.6	4.2
536-----Hanlon	90	34	72	3.8	6.3	3.3
729B-----Nodaway-Arenzville	95	36	75	4.0	6.6	3.6
760-----Ansgar	105	40	84	4.4	7.3	3.8
761-----Franklin	117	44	87	4.8	8.0	4.0
771B-----Waubeek	113	43	85	4.7	7.8	4.0

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Grass-legume hay	Bromegrass-alfalfa	Kentucky bluegrass
	Bu	Bu	Bu	Ton	AUM*	AUM*
933-----------------------Sawmill	104	40	83	4.4	7.3	4.1
977-----------------------Richwood	122	46	98	5.1	8.5	4.1
1119----------------------Muscatine	131	50	98	5.5	9.1	4.2
1133----------------------Colo	---	---	---	---	---	3.0
1160----------------------Walford	99	38	75	3.5	5.8	3.0
1220----------------------Nodaway	---	---	---	---	---	4.0
1291----------------------Atterberry	125	47	93	5.0	8.3	4.0

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for a period of 30 days.
** Yields are for areas protected from flooding.
*** See map unit description for the composition and behavior of the map unit.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed in this table. Absence of an entry in a column means the information was not available]

Soil name and map symbol	Ordi-nation symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Plant competi-tion	Common trees	Site index	
63B, 63C----------- Chelsea	3s	Slight	Slight	Moderate	Slight	White oak-----------	55	Eastern white pine, Scotch pine, European larch, eastern redcedar, red pine, jack pine.
63E---------------- Chelsea	3s	Moderate	Moderate	Moderate	Slight	White oak-----------	55	Eastern white pine, Scotch pine, European larch, eastern redcedar, red pine, jack pine.
65D2--------------- Lindley	5o	Slight	Slight	Slight	Slight	Blackjack oak------- Black oak-----------	50 ---	White oak, green ash, red pine, Scotch pine, eastern redcedar.
65E2, 65F2--------- Lindley	5r	Moderate	Moderate	Moderate	Slight	Blackjack oak------- Black oak-----------	50 ---	White oak, green ash, red pine, Scotch pine, eastern redcedar.
110C, 110E--------- Lamont	3o	Slight	Slight	Slight	Moderate	Northern red oak---- White oak-----------	55 55	Eastern white pine, Scotch pine, European larch, eastern redcedar.
143---------------- Brady	3s	Slight	Moderate	Slight	Moderate	White oak----------- Pin oak------------- Eastern white pine-- Quaking aspen-------	70 90 70 85	Red maple, European larch, eastern white pine, American sycamore.
162B, 162C, 162C2, 162D2------------- Downs	2o	Slight	Slight	Slight	Moderate	White oak----------- Northern red oak----	65 65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple.
163B, 163C, 163C2, 163D, 163D2, 163D3------------- Fayette	2o	Slight	Slight	Slight	Moderate	White oak----------- Northern red oak----	65 65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple.

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
163E, 163E3, 163F, 163F2: Fayette	2r	Moderate	Moderate	Slight	Moderate	White oak Northern red oak	65 65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple.
163G: Fayette	2r	Severe	Severe	Slight	Moderate	White oak Northern red oak	65 65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple.
171B, 171C2, 171D2: Bassett	3o	Slight	Slight	Slight	Slight	White oak Northern red oak	55 55	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple.
220: Nodaway	2o	Slight	Slight	Slight	Moderate	White oak	65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple.
291, 291B: Atterberry	3o	Slight	Slight	Slight	Slight	White oak Northern red oak Green ash Bur oak	70 70 --- ---	Eastern white pine, red pine, Scotch pine, eastern redcedar.
293C*, 293E*:								
Chelsea	3s	Slight	Slight	Moderate	Slight	White oak	55	Eastern white pine, Scotch pine, European larch, eastern redcedar, red pine, jack pine.
Lamont	3o	Slight	Slight	Slight	Moderate	Northern red oak White oak	55 55	Eastern white pine, Scotch pine, European larch, eastern redcedar.
Fayette	2o	Slight	Slight	Slight	Moderate	White oak Northern red oak	65 65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple.

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Potential productivity: Common trees	Site index	Trees to plant
293F*:								
Chelsea	3s	Moderate	Moderate	Moderate	Slight	White oak	55	Eastern white pine, Scotch pine, European larch, eastern redcedar, red pine, jack pine.
Lamont	3o	Slight	Slight	Slight	Moderate	Northern red oak White oak	55 55	Eastern white pine, Scotch pine, European larch, eastern redcedar.
Fayette	2r	Severe	Severe	Slight	Moderate	White oak Northern red oak	65 65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple.
320 Arenzville	2o	Slight	Slight	Slight	Severe	Northern red oak Bur oak Silver maple	65 --- ---	Red pine, eastern white pine, white spruce.
352B, 352C2 Whittier	2o	Slight	Slight	Slight	Moderate	White oak Northern red oak	65 65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple, poplar.
462B Downs	2o	Slight	Slight	Slight	Moderate	White oak Northern red oak	65 65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple.
463B Fayette	2o	Slight	Slight	Slight	Moderate	White oak Northern red oak	65 65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple.
729B*:								
Nodaway	2o	Slight	Slight	Slight	Moderate	White oak	65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple.
Arenzville	2o	Slight	Slight	Slight	Severe	Northern red oak Bur oak Silver maple	65 --- ---	Red pine, eastern white pine, white spruce.

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
761----------------- Franklin	2o	Slight	Slight	Slight	Moderate	White oak----------- Northern red oak----	65 65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple.
771B--------------- Waubeek	2o	Slight	Slight	Slight	Moderate	White oak----------- Northern red oak----	65 65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple.
1220--------------- Nodaway	2o	Slight	Slight	Slight	Moderate	White oak-----------	65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple.
1291--------------- Atterberry	3o	Slight	Slight	Slight	Slight	White oak----------- Northern red oak---- Green ash----------- Bur oak-------------	70 70 --- ---	Eastern white pine, red pine, Scotch pine, eastern redcedar.

* See map unit description for the composition and behavior of the map unit.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; the symbol > means greater than. Absence of an entry means that trees of the height class do not normally grow on this soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
8B-----Judson	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Siberian dogwood.	Amur maple, eastern redcedar.	Common hackberry, red pine, Norway spruce.	Eastern cottonwood, silver maple.
11B*:					
Colo-----	Redosier dogwood, silky dogwood.	Siberian dogwood, bloodtwig dogwood, Tatarian honeysuckle, Zabel honeysuckle.	Laurel willow, Amur maple, northern white-cedar.	Green ash	Silver maple, eastern cottonwood.
Ely-----	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
41B, 41C, 41E-----Sparta	American hazel, European privet.	Tamarisk, late lilac, forsythia, autumn-olive.	Austrian pine, tall purple willow.	Eastern white pine, red pine, jack pine.	---
63B, 63C, 63E-----Chelsea	Russian peashrub, gray dogwood, Koster redcedar.	Eastern redcedar, Russian-olive, Siberian crabapple, nannyberry viburnum.	Common hackberry, eastern white pine, red pine.	---	---
65D2, 65E2, 65F2--Lindley	Redosier dogwood, gray dogwood.	Flowering dogwood, eastern redbud, Amur honeysuckle, autumn-olive, rose-of-sharon, Amer cranberrybush.	Eastern redcedar, jack pine.	---	---
83B, 83C, 83C2----Kenyon	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
88-----Nevin	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
110C, 110E-----Lamont	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
118-----Garwin	Redosier dogwood, silky dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood, Zabel honeysuckle.	Amur maple, northern white-cedar, laurel willow.	Green ash	Eastern cottonwood, silver maple.
119, 119B-----Muscatine	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
120, 120B, 120C, 120C2, 120D2----- Tama	Redosier dogwood, gray dogwood.	Siberian dogwood, bloodtwig dogwood, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Silver maple, eastern cottonwood.
121--------------- Tama Variant	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Silver maple, eastern cottonwood.
122--------------- Sperry	Redosier dogwood, silky dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood, Zabel honeysuckle.	Amur maple, northern white-cedar, laurel willow.	Green ash---------	Eastern cottonwood, silver maple.
133, 133+--------- Colo	Redosier dogwood, silky dogwood.	Siberian dogwood, bloodtwig dogwood, Tatarian honeysuckle, Zabel honeysuckle.	Laurel willow, Amur maple, northern white-cedar.	Green ash---------	Silver maple, eastern cottonwood.
143--------------- Brady	Gray dogwood, dwarf purple willow.	Bloodtwig dogwood, Siberian dogwood.	Tall purple willow	Eastern white pine, pin oak.	---
160--------------- Walford	Redosier dogwood, silky dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood, Zabel honeysuckle.	Amur maple, northern white-cedar, laurel willow.	Green ash---------	Eastern cottonwood, silver maple.
162B, 162C, 162C2, 162D2----------- Downs	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
163B, 163C, 163C2, 163D, 163D2, 163D3, 163E, 163E3----------- Fayette	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Siberian dogwood.	Amur maple, eastern redcedar.	Common hackberry, red pine, Norway spruce.	Eastern cottonwood, silver maple.
163F, 163F2, 163G. Fayette					
171B, 171C2, 171D2----------- Bassett	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
175B, 175C-------- Dickinson	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Silver maple, eastern cottonwood.
177--------------- Saude	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
184. Klinger	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple, common hackberry.	Red pine, Norway spruce.	Eastern cottonwood, silver maple.
212. Kennebec	Gray dogwood, redosier dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Siberian dogwood.	Amur maple, eastern redcedar, common hackberry.	Red pine, Norway spruce.	Silver maple, eastern cottonwood.
214D. Rockton	Redosier dogwood, gray dogwood.	Siberian crabapple, gray dogwood, Tatarian honeysuckle, lilac.	Eastern redcedar, northern white-cedar, blue spruce, eastern white pine, common hackberry.	Green ash, Siberian elm.	---
220. Nodaway	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Siberian dogwood.	Amur maple, eastern redcedar, common hackberry.	Red pine, Norway spruce.	Eastern cottonwood, silver maple.
221. Palms	Gray dogwood, dwarf purple willow.	Northern white-cedar, Amur honeysuckle, silky dogwood.	Tall purple willow, medium purple willow, redosier dogwood.	---	Lombardy poplar.
291, 291B. Atterberry	Gray dogwood, Vanhoutte spirea.	Autumn-olive	Russian-olive	Norway spruce, Douglas-fir.	---
293C*, 293E*:					
Chelsea	Russian peashrub, gray dogwood, Koster redcedar.	Eastern redcedar, Russian-olive, Siberian crabapple, nannyberry viburnum.	Common hackberry, eastern white pine, red pine.	---	---
Lamont	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple, common hackberry.	Red pine, Norway spruce.	Eastern cottonwood, silver maple.
Fayette	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Siberian dogwood.	Amur maple, eastern redcedar, common hackberry.	Red pine, Norway spruce.	Eastern cottonwood, silver maple.
293F*:					
Chelsea.					
Lamont	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple, common hackberry.	Red pine, Norway spruce.	Eastern cottonwood, silver maple.
Fayette.					
315*:					
Loamy alluvial land.					
Spillville	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Siberian dogwood.	Amur maple, eastern redcedar, common hackberry.	Red pine, Norway spruce.	Eastern cottonwood, silver maple.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
320 Arenzville	Redosier dogwood, gray dogwood.	Northern white-cedar, lilac, common ninebark, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	Eastern cottonwood.
350B, 350C Waukegan	Redosier dogwood, gray dogwood.	Siberian crabapple, lilac, American plum, Tatarian honeysuckle.	Eastern redcedar, red pine, northern white-cedar, common hackberry, white spruce.	American elm, green ash.	Eastern cottonwood.
352B, 352C2 Whittier	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple, common hackberry.	Red pine, Norway spruce.	Eastern cottonwood, silver maple.
354*. Marsh					
377B, 377C, 377C2 Dinsdale	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple, common hackberry.	Red pine, Norway spruce.	Eastern cottonwood, silver maple.
382 Maxfield	Redosier dogwood, silky dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Siberian dogwood.	Laurel willow, Amur maple, Zabel honeysuckle, northern white-cedar.	Green ash	Silver maple, eastern cottonwood.
412E. Sogn					
420B Tama	Redosier dogwood, gray dogwood.	Siberian dogwood, bloodtwig dogwood, Tatarian honeysuckle.	Eastern redcedar, Amur maple, common hackberry.	Red pine, Norway spruce.	Silver maple, eastern cottonwood.
428B Ely	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple, common hackberry.	Red pine, Norway spruce.	Eastern cottonwood, silver maple.
442C*:					
Dickinson	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple, common hackberry.	Red pine, Norway spruce.	Silver maple, eastern cottonwood.
Tama	Redosier dogwood, gray dogwood.	Siberian dogwood, bloodtwig dogwood, Tatarian honeysuckle.	Eastern redcedar, Amur maple, common hackberry.	Red pine, Norway spruce.	Silver maple, eastern cottonwood.
462B Downs	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple, common hackberry.	Red pine, Norway spruce, eastern white pine.	Eastern cottonwood, silver maple.
463B Fayette	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Siberian dogwood.	Amur maple, eastern redcedar, common hackberry.	Red pine, Norway spruce, eastern white pine.	Eastern cottonwood, silver maple.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
467: Radford	Redosier dogwood, silky dogwood.	Northern white-cedar, redosier dogwood, nannyberry viburnum.	Green ash, white spruce.	Eastern white pine, jack pine, silver maple.	Eastern cottonwood.
478G*:					
Rock outcrop.					
Sogn.					
485: Spillville	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Siberian dogwood.	Amur maple, eastern redcedar, common hackberry.	Red pine, Norway spruce.	Eastern cottonwood, silver maple.
536: Hanlon	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Siberian dogwood.	Amur maple, eastern redcedar. common hackberry.	Red pine, Norway spruce.	Eastern cottonwood, silver maple.
729B*:					
Nodaway	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Siberian dogwood.	Amur maple, eastern redcedar, common hackberry.	Red pine, Norway spruce.	Eastern cottonwood, silver maple.
Arenzville	Redosier dogwood, silky dogwood.	Northern white-cedar, lilac, common ninebark, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	Eastern cottonwood.
760: Ansgar	Redosier dogwood, silky dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood, Zabel honeysuckle.	Amur maple, northern white-cedar, laurel willow.	Green ash	Eastern cottonwood, silver maple.
761: Franklin	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple, common hackberry.	Red pine, Norway spruce.	Eastern cottonwood, silver maple.
771B: Waubeek	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple, common hackberry.	Red pine, Norway spruce.	Eastern cottonwood, silver maple.
933: Sawmill	Redosier dogwood, silky dogwood.	Silky dogwood	Amur maple	Green ash, pin oak	---
977: Richwood	Redosier dogwood, gray dogwood.	Northern white-cedar, lilac, common ninebark, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
1119: Muscatine	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple, common hackberry.	Red pine, Norway spruce, eastern white pine.	Eastern cottonwood, silver maple.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
1133. Colo	Redosier dogwood, silky dogwood.	Siberian dogwood, bloodtwig dogwood, Tatarian honeysuckle, Zabel honeysuckle.	Laurel willow, Amur maple, northern white-cedar.	Green ash	Silver maple, eastern cottonwood.
1160. Walford	Redosier dogwood, silky dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood, Zabel honeysuckle.	Amur maple, northern white-cedar, laurel willow.	Green ash	Eastern cottonwood, silver maple.
1220. Nodaway	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Siberian dogwood.	Amur maple, eastern redcedar, common hackberry.	Red pine, Norway, spruce, eastern white pine.	Eastern cottonwood, silver maple.
1291. Atterberry	Gray dogwood, Vanhoutte spirea.	Autumn-olive	Russian-olive	Norway spruce, Douglas-fir, eastern white pine.	---

* See map unit description for the composition and behavior of the map unit.

TABLE 8.--BUILDING SITE DEVELOPMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
8B: Judson	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.
11B*:					
Colo	Severe: wetness, floods.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, low strength.
Ely	Severe: wetness.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: frost action, low strength.
41B: Sparta	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
41C: Sparta	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
41E: Sparta	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
63B: Chelsea	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
63C: Chelsea	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
63E: Chelsea	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
65D2: Lindley	Moderate: too clayey, slope.	Moderate: shrink-swell, low strength, slope.	Moderate: shrink-swell, slope, low strength.	Severe: slope.	Severe: low strength.
65E2, 65F2: Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
83B: Kenyon	Slight	Slight	Slight	Slight	Severe: low strength.
83C, 83C2: Kenyon	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.
88: Nevin	Severe: wetness.	Moderate: wetness, shrink-swell, low strength.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action, low strength.
110C: Lamont	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.
110E: Lamont	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.

See footnotes at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
118 Garwin	Severe: wetness.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: frost action, low strength.
119, 119B Muscatine	Severe: wetness.	Moderate: wetness, low strength, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.
120**, 120B** Tama	Slight	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.
120C, 120C2 Tama	Slight	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: slope, shrink-swell, low strength.	Severe: frost action, low strength.
120D2 Tama	Moderate: slope.	Moderate: slope, low strength, shrink-swell.	Moderate: slope, low strength, shrink-swell.	Severe: slope.	Severe: frost action, low strength.
121 Tama Variant	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength, frost action.
122 Sperry	Severe: wetness, floods.	Severe: wetness, shrink-swell, floods.	Severe: shrink-swell, wetness, floods.	Severe: shrink-swell, wetness, floods.	Severe: frost action, wetness, low strength.
133, 133+ Colo	Severe: wetness, floods.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, low strength.
143 Brady	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, wetness.
160 Walford	Severe: wetness.	Severe: wetness, low strength, shrink-swell.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.
162B Downs	Slight	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.
162C, 162C2, 162D2 Downs	Slight	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: slope, shrink-swell, low strength.	Severe: frost action, low strength.
163B Fayette	Slight	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.
163C, 163C2 Fayette	Slight	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: slope, shrink-swell, low strength.	Severe: frost action, low strength.

See footnotes at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
163D, 163D2, 163D3 Fayette	Moderate: slope.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, low strength, shrink-swell.	Severe: slope.	Severe: frost action, low strength.
163E, 163E3, 163F, 163F2, 163G Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.
171B Bassett	Slight	Slight	Slight	Slight	Severe: low strength.
171C2 Bassett	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.
171D2 Bassett	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.
175B Dickinson	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.
175C Dickinson	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.
177 Saude	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: low strength.
184 Klinger	Severe: wetness.	Moderate: wetness, shrink-swell, low strength.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action, low strength.
212 Kennebec	Moderate: wetness.	Moderate: shrink-swell, low strength.	Moderate: wetness, shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength, frost action.
214D Rockton	Moderate: depth to rock, slope.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: low strength.
220 Nodaway	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action.
221 Palms	Severe: wetness, excess humus, floods.	Severe: wetness, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.
291, 291B Atterberry	Severe: wetness.	Severe: low strength, wetness.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: frost action, low strength.
293C*:					
Chelsea	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Lamont	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.

See footnotes at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
293C*:					
Fayette	Slight	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: slope, shrink-swell, low strength.	Severe: frost action, low strength.
293E*:					
Chelsea	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Lamont	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
Fayette	Moderate: slope.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, low strength, shrink-swell.	Severe: slope.	Severe: frost action, low strength.
293F*:					
Chelsea	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Lamont	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.
315*:					
Loamy alluvial land.					
Spillville	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods.
320 Arenzville	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action, low strength.
350B Waukegan	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
350C Waukegan	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
352B Whittier	Severe: cutbanks cave.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
352C2 Whittier	Severe: cutbanks cave.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: low strength.
354*. Marsh					
377B Dinsdale	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.

See footnotes at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
377C, 377C2------- Dinsdale	Slight-----------	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: frost action, low strength.
382--------------- Maxfield	Severe: wetness.	Severe: wetness, low strength, shrink-swell.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, low strength, shrink-swell.	Severe: frost action, low strength.
412E-------------- Sogn	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.
420B-------------- Tama	Slight-----------	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.
428B-------------- Ely	Severe: wetness.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: frost action, low strength.
442C*:					
Dickinson--------	Severe: cutbanks cave.	Slight-----------	Slight-----------	Moderate: slope.	Moderate: frost action.
Tama-------------	Slight-----------	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: slope, shrink-swell, low strength.	Severe: frost action, low strength.
462B-------------- Downs	Slight-----------	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.
463B-------------- Fayette	Slight-----------	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.
467--------------- Radford	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action, low strength.
478G*: Rock outcrop.					
Sogn-------------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.
485--------------- Spillville	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods.
536--------------- Hanlon	Severe: floods, cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
729B*:					
Nodaway----------	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action.
Arenzville-------	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action, low strength.

See footnotes at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
760 Ansgar	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: frost action, low strength.
761 Franklin	Severe: wetness.	Moderate: wetness, shrink-swell, low strength.	Severe: wetness.	Moderate: wetness, shrink-swell, low strength.	Severe: frost action, low strength.
771B Waubeek	Slight	Moderate: shrink-swell, low strength.	Moderate: low strength, shrink-swell.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.
933 Sawmill	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, low strength.
977 Richwood	Severe: cutbanks cave.	Slight	Slight	Slight	Severe: frost action.
1119 Muscatine	Severe: wetness.	Moderate: wetness, low strength, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.
1133 Colo	Severe: wetness, floods.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, low strength, wetness.
1160 Walford	Severe: wetness.	Severe: wetness, low strength, shrink-swell.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.
1220 Nodaway	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action.
1291 Atterberry	Severe: wetness.	Severe: low strength, wetness.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: frost action, low strength.

* See map unit description for the composition and behavior of the map unit.

** In the nearly level areas limestone bedrock is about 6 to 7 feet below the surface.

TABLE 9.--SANITARY FACILITIES

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils. Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
8B Judson	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
11B*:					
Colo	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Ely	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
41B Sparta	Slight**	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
41C Sparta	Slight	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
41E Sparta	Moderate:** slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
63B Chelsea	Slight**	Severe: wetness.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
63C Chelsea	Slight**	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
63E Chelsea	Moderate:** slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
65D2 Lindley	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: slope, too clayey.
65E2, 65F2 Lindley	Severe: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Severe: slope.	Poor: slope.
83B Kenyon	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
83C, 83C2 Kenyon	Moderate: percs slowly.	Severe: slope, seepage.	Slight	Slight	Good.
88 Nevin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
110C Lamont	Slight**	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
110E Lamont	Moderate:** slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope.

See footnotes at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
118----------------- Garwin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
119, 119B----------- Muscatine	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
120***-------------- Tama	Slight-----------	Moderate: seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
120B---------------- Tama	Slight-----------	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
120C, 120C2--------- Tama	Slight-----------	Severe: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
120D2--------------- Tama	Moderate: slope.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: slope, too clayey.
121----------------- Tama Variant	Slight-----------	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
122----------------- Sperry	Severe: percs slowly, wetness, floods.	Severe: wetness.	Severe: wetness, floods, too clayey.	Severe: wetness, floods.	Poor: wetness.
133, 133+----------- Colo	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
143----------------- Brady	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
160----------------- Walford	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness.	Severe: wetness.	Poor: wetness.
162B---------------- Downs	Slight-----------	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
162C, 162C2, 162D2-- Downs	Slight-----------	Severe: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
163B---------------- Fayette	Slight-----------	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
163C, 163C2--------- Fayette	Slight-----------	Severe: slope, seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
163D, 163D2, 163D3-- Fayette	Moderate: slope.	Severe: slope, seepage.	Moderate: too clayey.	Moderate: slope.	Fair: slope, too clayey.
163E, 163E3, 163F, 163F2-------------- Fayette	Severe: slope.	Severe: slope, seepage.	Moderate: slope, too clayey.	Severe: slope.	Poor: slope.

See footnotes at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
163G----------------- Fayette	Severe: slope.	Severe: slope, seepage.	Severe: slope.	Severe: slope.	Poor: slope.
171B----------------- Bassett	Moderate: percs slowly.	Moderate: slope, seepage.	Slight-----------	Slight-----------	Good.
171C2---------------- Bassett	Moderate: percs slowly.	Severe: slope.	Slight-----------	Slight-----------	Good.
171D2---------------- Bassett	Moderate: percs slowly, slope.	Severe: slope.	Slight-----------	Moderate: slope.	Fair: slope.
175B----------------- Dickinson	Slight**---------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
175C----------------- Dickinson	Slight**---------	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage.
177------------------ Saude	Slight**---------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy, seepage.
184------------------ Klinger	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
212------------------ Kennebec	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Good.
214D----------------- Rockton	Severe: depth to rock.	Severe: slope.	Severe: depth to rock.	Moderate: slope, depth to rock.	Poor: area reclaim.
220------------------ Nodaway	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: wetness.
221------------------ Palms	Severe: wetness, floods, subsides.	Severe: wetness, seepage, floods.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Poor: wetness, hard to pack.
291, 291B------------ Atterberry	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
293C*:					
Chelsea--------------	Slight**---------	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Lamont---------------	Slight**---------	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Good.
Fayette--------------	Slight-----------	Severe: slope, seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
293E*:					
Chelsea--------------	Moderate:** slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.

See footnotes at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
293E*:					
Lamont	Moderate:** slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope.
Fayette	Moderate: slope.	Severe: slope, seepage.	Moderate: too clayey.	Moderate: slope.	Fair: slope, too clayey.
293F*:					
Chelsea	Severe: slope.	Severe: seepage, slope.	Severe: seepage, too sandy, slope.	Severe: seepage, slope.	Poor: too sandy, slope, seepage.
Lamont	Severe: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage, slope.	Poor: slope.
Fayette	Severe: slope.	Severe: slope, seepage.	Severe: slope.	Severe: slope.	Poor: slope.
315*:					
Loamy alluvial land.					
Spillville	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Severe: wetness, seepage, floods.	Severe: wetness, seepage, floods.	Fair: wetness.
320 Arenzville	Severe: floods, wetness.	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: wetness.
350B Waukegan	Slight**	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
350C Waukegan	Slight**	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Good.
352B Whittier	Slight**	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy, seepage.
352C2 Whittier	Slight**	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: too sandy, seepage.
354*. Marsh					
377B Dinsdale	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
377C, 377C2 Dinsdale	Slight	Severe: slope, seepage.	Slight	Slight	Good.
382 Maxfield	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
412E Sogn	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.

See footnotes at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
420B: Tama	Slight	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
428B: Ely	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
442C*:					
Dickinson	Slight**	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage.
Tama	Slight	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
462B: Downs	Slight	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
463B: Fayette	Moderate: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
467: Radford	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
478G*:					
Rock outcrop.					
Sogn	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
485: Spillville	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Severe: wetness, seepage, floods.	Severe: wetness, seepage, floods.	Fair: wetness.
536: Hanlon	Severe: floods, wetness.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Fair: wetness.
729B*:					
Nodaway	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: wetness.
Arenzville	Severe: floods, wetness.	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: wetness.
760: Ansgar	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
761: Franklin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
771B: Waubeek	Slight	Moderate: slope, seepage.	Slight	Slight	Good.

See footnotes at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
933----------------- Sawmill	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
977----------------- Richwood	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
1119---------------- Muscatine	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
1133---------------- Colo	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
1160---------------- Walford	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness.	Severe: wetness.	Poor: wetness.
1220---------------- Nodaway	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: wetness.
1291---------------- Atterberry	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.

* See map unit description for the composition and behavior of the map unit.

** Because of rapid or very rapid permeability, the ground water may be polluted.

*** Limestone bedrock is 6 to 7 feet below the surface.

TABLE 10.--CONSTRUCTION MATERIALS

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," and "unsuited." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
8B Judson	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
11B*:				
Colo	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Ely	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
41B, 41C Sparta	Good	Good	Unsuited: excess fines.	Fair: too sandy.
41E Sparta	Good	Good	Unsuited: excess fines.	Fair: too sandy, slope.
63B, 63C, 63E Chelsea	Good	Good	Unsuited: excess fines.	Poor: too sandy.
65D2 Lindley	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
65E2, 65F2 Lindley	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
83B, 83C, 83C2 Kenyon	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
88 Nevin	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
110C Lamont	Good	Fair: excess fines.	Unsuited: excess fines.	Good.
110E Lamont	Good	Fair: excess fines.	Unsuited: excess fines.	Fair: slope.
118 Garwin	Poor: wetness, low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
119, 119B Muscatine	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
120, 120B, 120C, 120C2 Tama	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
120D2 Tama	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
121 Tama Variant	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
122 Sperry	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
133, 133+ Colo	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
143 Brady	Poor: wetness.	Good	Good	Good.
160 Walford	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
162B, 162C, 162C2, 162D2 Downs	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
163B, 163C, 163C2 Fayette	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
163D, 163D2, 163D3 Fayette	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
163E, 163E3, 163F, 163F2 Fayette	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
163G Fayette	Poor: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
171B, 171C2 Bassett	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
171D2 Bassett	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
175B, 175C Dickinson	Good	Fair: excess fines.	Unsuited: excess fines.	Good.
177 Saude	Good	Good	Good	Good.
184 Klinger	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
212 Kennebec	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
214D Rockton	Poor: low strength, thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, area reclaim.
220 Nodaway	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
221 Palms	Poor: wetness, low strength.	Unsuited: excess humus, excess fines.	Unsuited: excess humus, excess fines.	Poor: wetness, excess humus.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
291, 291B Atterberry	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
293C*:				
Chelsea	Good	Good	Unsuited: excess fines.	Poor: too sandy.
Lamont	Good	Fair: excess fines.	Unsuited: excess fines.	Good.
Fayette	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
293E*:				
Chelsea	Good	Good	Unsuited: excess fines.	Poor: too sandy.
Lamont	Good	Fair: excess fines.	Unsuited: excess fines.	Fair: slope.
Fayette	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
293F*:				
Chelsea	Poor: slope.	Good	Unsuited: excess fines.	Poor: too sandy, slope.
Lamont		Fair: excess fines.	Unsuited: excess fines.	Poor: slope.
Fayette	Poor: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
315*: Loamy alluvial land.				
Spillville	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
320 Arenzville	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
350B, 350C Waukegan	Good	Good	Unsuited: excess fines.	Good.
352B, 352C2 Whittier	Good	Fair: excess fines.	Unsuited: excess fines.	Good.
354*. Marsh				
377B, 377C, 377C2 Dinsdale	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
382 Maxfield	Poor: wetness, low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
412E Sogn	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: area reclaim.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
420B------------------ Tama	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
428B------------------ Ely	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
442C*:				
Dickinson-----------	Good----------------	Fair: excess fines.	Unsuited: excess fines.	Good.
Tama-----------------	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
462B------------------ Downs	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
463B------------------ Fayette	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
467------------------- Radford	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
478G*: Rock outcrop.				
Sogn-----------------	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: area reclaim.
485------------------- Spillville	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
536------------------- Hanlon	Fair: low strength, wetness.	Poor: excess fines.	Unsuited: excess fines.	Good.
729B*:				
Nodaway--------------	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Arenzville-----------	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
760------------------- Ansgar	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
761------------------- Franklin	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
771B------------------ Waubeek	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
933------------------- Sawmill	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
977------------------- Richwood	Good----------------	Good----------------	Unsuited: excess fines.	Good.
1119------------------ Muscatine	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1133------------------ Colo	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
1160------------------ Walford	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
1220------------------ Nodaway	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
1291------------------ Atterberry	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.

* See map unit description for the composition and behavior of the map unit.

TABLE 11.--WATER MANAGEMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. Absence of an entry means soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
8B Judson	Seepage	Favorable	Not needed	Favorable	Erodes easily	Erodes easily.
11B*:						
Colo	Seepage	Hard to pack	Floods, frost action.	Floods, wetness.	Wetness	Wetness.
Ely	Seepage	Wetness	Frost action	Wetness	Wetness	Erodes easily.
41B Sparta	Seepage	Piping, seepage.	Not needed	Fast intake, droughty.	Too sandy, soil blowing.	Droughty.
41C Sparta	Slope, seepage.	Piping, seepage.	Not needed	Fast intake, slope, droughty.	Too sandy, soil blowing.	Droughty.
41E Sparta	Slope, seepage.	Piping, seepage.	Not needed	Fast intake, slope, droughty.	Too sandy, soil blowing, slope.	Slope, droughty.
63B Chelsea	Seepage	Piping, seepage.	Not needed	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
63C Chelsea	Slope, seepage.	Piping, seepage.	Not needed	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
63E Chelsea	Slope, seepage.	Piping, seepage.	Not needed	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
65D2 Lindley	Slope	Favorable	Not needed	Slope	Favorable	Slope.
65E2, 65F2 Lindley	Slope	Favorable	Not needed	Slope	Slope	Slope.
83B Kenyon	Seepage	Favorable	Not needed	Favorable	Favorable	Favorable.
83C, 83C2 Kenyon	Slope, seepage.	Favorable	Not needed	Slope	Favorable	Favorable.
88 Nevin	Seepage	Wetness	Frost action	Favorable	Not needed	Erodes easily.
110C Lamont	Seepage	Piping, seepage.	Not needed	Soil blowing	Too sandy, soil blowing.	Favorable.
110E Lamont	Slope, seepage.	Piping, seepage.	Not needed	Slope, soil blowing.	Slope, too sandy, soil blowing.	Slope.
118 Garwin	Seepage	Wetness, hard to pack.	Frost action	Wetness	Not needed	Wetness.
119 Muscatine	Seepage	Wetness	Frost action	Wetness	Not needed	Erodes easily.
119B Muscatine	Seepage	Wetness	Frost action	Wetness	Wetness, erodes easily.	Erodes easily.
120 Tama	Seepage**	Favorable**	Not needed	Favorable	Not needed	Erodes easily.

See footnotes at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
120B------------- Tama	Seepage--------	Favorable------	Not needed-----	Favorable------	Erodes easily	Erodes easily.
120C, 120C2------- Tama	Slope, seepage.	Favorable------	Not needed-----	Slope----------	Erodes easily	Erodes easily.
120D2------------- Tama	Slope, seepage.	Favorable------	Not needed-----	Slope----------	Erodes easily	Slope, erodes easily.
121--------------- Tama Variant	Seepage--------	Favorable------	Not needed-----	Favorable------	Erodes easily	Erodes easily.
122--------------- Sperry	Favorable------	Wetness--------	Percs slowly, frost action, floods.	Percs slowly, wetness, floods.	Not needed-----	Wetness, percs slowly, erodes easily.
133, 133+--------- Colo	Seepage--------	Hard to pack---	Floods, frost action.	Floods, wetness.	Not needed-----	Wetness.
143--------------- Brady	Seepage--------	Seepage, wetness.	Frost action---	Wetness, fast intake, soil blowing.	Not needed-----	Wetness.
160--------------- Walford	Favorable------	Wetness, hard to pack.	Percs slowly, frost action.	Wetness, percs slowly.	Not needed-----	Wetness, percs slowly, erodes easily.
162B-------------- Downs	Seepage--------	Favorable------	Not needed-----	Favorable------	Erodes easily	Erodes easily.
162C, 162C2, 162D2------------ Downs	Slope, seepage.	Favorable------	Not needed-----	Slope----------	Erodes easily	Erodes easily.
163B-------------- Fayette	Seepage--------	Favorable------	Not needed-----	Erodes easily	Favorable------	Erodes easily.
163C, 163C2------- Fayette	Slope, seepage.	Favorable------	Not needed-----	Slope, erodes easily.	Favorable------	Erodes easily.
163D, 163D2, 163D3------------ Fayette	Slope, seepage.	Favorable------	Not needed-----	Slope, erodes easily.	Favorable------	Slope, erodes easily.
163E, 163E3, 163F, 163F2, 163G------ Fayette	Slope, seepage.	Favorable------	Not needed-----	Slope, erodes easily.	Slope----------	Slope, erodes easily.
171B-------------- Bassett	Favorable------	Favorable------	Not needed-----	Favorable------	Favorable------	Erodes easily.
171C2------------- Bassett	Slope----------	Favorable------	Not needed-----	Slope----------	Favorable------	Erodes easily.
171D2------------- Bassett	Slope----------	Favorable------	Not needed-----	Slope----------	Favorable------	Slope, erodes easily.
175B-------------- Dickinson	Seepage--------	Seepage--------	Not needed-----	Soil blowing---	Soil blowing---	Droughty.
175C-------------- Dickinson	Slope, seepage.	Seepage--------	Not needed-----	Slope, soil blowing.	Soil blowing---	Droughty.
177--------------- Saude	Seepage--------	Seepage--------	Not needed-----	Favorable------	Too sandy------	Favorable.
184--------------- Klinger	Seepage--------	Wetness--------	Frost action---	Wetness--------	Wetness, erodes easily.	Erodes easily.

See footnotes at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
212 Kennebec	Seepage	Favorable	Floods	Floods, wetness.	Not needed	Erodes easily.
214D Rockton	Slope, seepage, depth to rock.	Thin layer	Not needed	Slope, rooting depth.	Depth to rock	Depth to rock, slope.
220 Nodaway	Seepage	Favorable	Not needed	Floods, erodes easily.	Not needed	Erodes easily.
221 Palms	Seepage	Excess humus, wetness.	Floods, frost action.	Wetness, soil blowing, floods.	Not needed	Wetness.
291, 291B Atterberry	Favorable	Hard to pack, wetness.	Frost action	Wetness	Not needed	Wetness, erodes easily.
293C*:						
Chelsea	Slope, seepage.	Piping, seepage.	Not needed	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Lamont	Slope, seepage.	Piping, seepage.	Not needed	Slope, soil blowing.	Too sandy, soil blowing.	Favorable.
Fayette	Slope, seepage.	Favorable	Not needed	Slope, erodes easily.	Favorable	Erodes easily.
293E*, 293F*:						
Chelsea	Slope, seepage.	Piping, seepage.	Not needed	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Lamont	Slope, seepage.	Piping, seepage.	Not needed	Slope, soil blowing.	Slope, too sandy, soil blowing.	Slope.
Fayette	Slope, seepage.	Favorable	Not needed	Slope, erodes easily.	Slope	Slope, erodes easily.
315*:						
Loamy alluvial land.						
Spillville	Seepage	Favorable	Not needed	Floods	Not needed	Favorable.
320 Arenzville	Seepage	Piping	Not needed	Floods, erodes easily.	Not needed	Erodes easily.
350B Waukegan	Seepage	Seepage	Not needed	Favorable	Erodes easily, too sandy.	Erodes easily, slope.
350C Waukegan	Slope, seepage.	Seepage	Not needed	Slope	Erodes easily, too sandy.	Erodes easily, slope.
352B Whittier	Seepage	Seepage	Not needed	Favorable	Erodes easily	Erodes easily.
352C2 Whittier	Slope, seepage.	Seepage	Not needed	Slope	Erodes easily	Erodes easily.
354*. Marsh						
377B Dinsdale	Seepage	Favorable	Not needed	Favorable	Favorable	Erodes easily.
377C, 377C2 Dinsdale	Slope, seepage.	Favorable	Not needed	Slope	Favorable	Erodes easily.

See footnotes at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
382 Maxfield	Seepage	Wetness, hard to pack.	Frost action	Wetness	Not needed	Wetness.
412E Sogn	Slope, depth to rock.	Thin layer	Not needed	Droughty, rooting depth, slope.	Depth to rock, slope.	Slope, droughty, rooting depth.
420B Tama	Seepage	Favorable	Not needed	Favorable	Erodes easily	Erodes easily.
428B Ely	Seepage	Wetness	Frost action	Wetness	Wetness	Erodes easily.
442C*:						
Dickinson	Slope, seepage.	Seepage	Not needed	Slope, soil blowing.	Soil blowing	Droughty.
Tama	Slope, seepage.	Favorable	Not needed	Slope	Erodes easily	Erodes easily.
462B Downs	Seepage	Favorable	Not needed	Favorable	Erodes easily	Erodes easily.
463B Fayette	Seepage	Favorable	Not needed	Erodes easily	Favorable	Erodes easily.
467 Radford	Seepage	Wetness	Floods, frost action.	Wetness, floods.	Not needed	Wetness.
478G*:						
Rock outcrop.						
Sogn	Slope, depth to rock.	Thin layer	Not needed	Droughty, rooting depth, slope.	Depth to rock, slope.	Slope, droughty, rooting depth.
485 Spillville	Seepage	Favorable	Not needed	Floods	Not needed	Favorable.
536 Hanlon	Seepage	Seepage	Floods	Floods, soil blowing.	Not needed	Favorable.
729B*:						
Nodaway	Seepage	Favorable	Not needed	Floods, erodes easily.	Not needed	Erodes easily.
Arenzville	Seepage	Piping	Not needed	Floods, erodes easily.	Not needed	Erodes easily.
760 Ansgar	Favorable	Wetness	Frost action	Wetness	Not needed	Wetness, erodes easily.
761 Franklin	Seepage	Wetness	Frost action	Wetness	Wetness, erodes easily.	Erodes easily.
771B Waubeek	Seepage	Favorable	Not needed	Favorable	Erodes easily	Erodes easily.
933 Sawmill	Favorable	Wetness	Floods, frost action.	Wetness, floods.	Not needed	Wetness.
977 Richwood	Seepage	Piping	Not needed	Favorable	Not needed	Erodes easily.
1119 Muscatine	Seepage	Wetness	Frost action	Wetness	Not needed	Erodes easily.
1133 Colo	Favorable	Hard to pack, wetness.	Floods, frost action.	Floods, wetness.	Not needed	Wetness.

See footnotes at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1160-------------- Walford	Favorable------	Wetness, hard to pack.	Percs slowly, frost action.	Wetness, percs slowly.	Not needed-----	Wetness, percs slowly, erodes easily.
1220-------------- Nodaway	Seepage--------	Favorable------	Not needed-----	Floods, erodes easily.	Not needed-----	Erodes easily.
1291-------------- Atterberry	Favorable------	Hard to pack, wetness.	Frost action---	Wetness--------	Not needed-----	Wetness, erodes easily.

* See map unit description for the composition and behavior of the map unit.

** Limestone bedrock is 6 to 7 feet below the surface.

TABLE 12.--RECREATIONAL DEVELOPMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
8B------------------- Judson	Slight---------------	Slight---------------	Moderate: slope.	Slight.
11B*:				
Colo-----------------	Severe: floods, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
Ely------------------	Slight---------------	Slight---------------	Moderate: slope.	Slight.
41B------------------ Sparta	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.
41C------------------ Sparta	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.
41E------------------ Sparta	Moderate: too sandy, slope.	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy.
63B------------------ Chelsea	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.
63C------------------ Chelsea	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.
63E------------------ Chelsea	Moderate: too sandy, slope.	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy.
65D2----------------- Lindley	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Slight.
65E2, 65F2----------- Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
83B------------------ Kenyon	Slight---------------	Slight---------------	Moderate: slope.	Slight.
83C, 83C2------------ Kenyon	Slight---------------	Slight---------------	Severe: slope.	Slight.
88------------------- Nevin	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight.
110C----------------- Lamont	Slight---------------	Slight---------------	Moderate: slope.	Slight.
110E----------------- Lamont	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
118------------------ Garwin	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
119------------------ Muscatine	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
119B Muscatine	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight.
120 Tama	Slight	Slight	Slight	Slight.
120B Tama	Slight	Slight	Moderate: slope.	Slight.
120C, 120C2 Tama	Slight	Slight	Severe: slope.	Slight.
120D2 Tama	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
121 Tama Variant	Slight	Slight	Moderate: slope.	Slight.
122 Sperry	Severe: percs slowly, wetness, floods.	Severe: wetness.	Severe: percs slowly, wetness, floods.	Severe: wetness.
133, 133+ Colo	Severe: floods, wetness.	Moderate: wetness.	Severe: wetness, floods.	Moderate: wetness.
143 Brady	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
160 Walford	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
162B Downs	Slight	Slight	Moderate: slope.	Slight.
162C, 162C2, 162D2 Downs	Slight	Slight	Severe: slope.	Slight.
163B Fayette	Slight	Slight	Moderate: slope.	Slight.
163C, 163C2 Fayette	Slight	Slight	Severe: slope.	Slight.
163D, 163D2 Fayette	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
163D3 Fayette	Moderate: slope, too clayey.	Moderate: slope, too clayey.	Severe: slope.	Moderate: too clayey.
163E Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
163E3 Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too clayey, slope.
163F, 163F2 Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
163G Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
171B: Bassett	Slight	Slight	Moderate: slope.	Slight.
171C2: Bassett	Slight	Slight	Severe: slope.	Slight.
171D2: Bassett	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
175B: Dickinson	Slight	Slight	Moderate: slope.	Slight.
175C: Dickinson	Slight	Slight	Severe: slope.	Slight.
177: Saude	Slight	Slight	Moderate: slope.	Slight.
184: Klinger	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness, percs slowly.	Slight.
212: Kennebec	Severe: floods.	Slight	Moderate: floods.	Slight.
214D: Rockton	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
220: Nodaway	Severe: floods.	Slight	Moderate: floods.	Slight.
221: Palms	Severe: wetness, floods, excess humus.	Severe: wetness, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, excess humus.
291, 291B: Atterberry	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
293C*:				
Chelsea	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.
Lamont	Slight	Slight	Severe: slope.	Slight.
Fayette	Slight	Slight	Severe: slope.	Slight.
293E*:				
Chelsea	Moderate: too sandy, slope.	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy.
Lamont	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Fayette	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
293F*:				
Chelsea	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
293F*:				
Lamont	Severe: slope.	Severe: slope.	Severe: slope.	
Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
315*:				
Loamy alluvial land.				
Spillville	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
320 Arenzville	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
350B Waukegan	Slight	Slight	Moderate: slope.	Slight.
350C Waukegan	Slight	Slight	Severe: slope.	Slight.
352B Whittier	Slight	Slight	Moderate: slope.	Slight.
352C2 Whittier	Slight	Slight	Severe: slope.	Slight.
354*. Marsh				
377B Dinsdale	Slight	Slight	Moderate: slope.	Slight.
377C, 377C2 Dinsdale	Slight	Slight	Severe: slope.	Slight.
382 Maxfield	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
412E Sogn	Severe: depth to rock.	Moderate: slope.	Severe: depth to rock, slope.	Slight.
420B Tama	Slight	Slight	Moderate: slope.	Slight.
428B Ely	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight.
442C*:				
Dickinson	Slight	Slight	Severe: slope.	Slight.
Tama	Slight	Slight	Severe: slope.	Slight.
462B Downs	Slight	Slight	Moderate: slope.	Slight.
463B Fayette	Slight	Slight	Moderate: slope.	Slight.
467 Radford	Severe: floods, wetness.	Moderate: wetness.	Severe: wetness, floods.	Moderate: wetness.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
478G*:				
Rock outcrop.				
Sogn	Severe: depth to rock.	Moderate: slope.	Severe: depth to rock, slope.	Slight.
485 Spillville	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
536 Hanlon	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
729B*:				
Nodaway	Severe: floods.	Slight	Moderate: floods.	Slight.
Arenzville	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
760 Ansgar	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
761 Franklin	Moderate: wetness.	Moderate: wetness.	Moderate: wetness, slope.	Slight.
771B Waubeek	Slight	Slight	Moderate: slope.	Slight.
933 Sawmill	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
977 Richwood	Slight	Slight	Slight	Slight.
1119 Muscatine	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight.
1133 Colo	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
1160 Walford	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
1220 Nodaway	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
1291 Atterberry	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.

* See map unit description for the composition and behavior of the map unit.

TABLE 13.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
8B---------------- Judson	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
11B*:										
Colo--------------	Good	Fair	Good	Fair	Poor	Fair	Very poor.	Fair	Fair	Poor.
Ely---------------	Good	Good	Good	Good	Good	Fair	Very poor.	Good	Good	Poor.
41B, 41C, 41E------ Sparta	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
63B, 63C----------- Chelsea	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
63E---------------- Chelsea	Very poor.	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
65D2--------------- Lindley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
65E2, 65F2--------- Lindley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
83B---------------- Kenyon	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
83C, 83C2---------- Kenyon	Fair	Good	Good	Good	Good	Poor	Fair	Good	Good	Fair.
88----------------- Nevin	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
110C, 110E--------- Lamont	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
118---------------- Garwin	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
119, 119B---------- Muscatine	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
120, 120B---------- Tama	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
120C, 120C2, 120D2- Tama	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
121---------------- Tama Variant	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
122---------------- Sperry	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
133, 133+---------- Colo	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
143---------------- Brady	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.

See footnote at end of table.

TABLE 13.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
160----------------Walford	Fair	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
162B---------------Downs	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
162C, 162C2, 162D2-Downs	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
163B---------------Fayette	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
163C, 163C2, 163D, 163D2, 163D3------Fayette	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
163E, 163E3, 163F, 163F2-------------Fayette	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
163G---------------Fayette	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.
171B---------------Bassett	Fair	Good	Good	Good	Good	Poor	Fair	Good	Good	Fair.
171C2, 171D2. Bassett										
175B---------------Dickinson	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
175C---------------Dickinson	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
177----------------Saude	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
184----------------Klinger	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
212----------------Kennebec	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
214D---------------Rockton	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
220----------------Nodaway	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Good	Fair.
221----------------Palms	Good	Poor	Poor	Poor	Poor	Poor	Poor	Fair	Poor	Poor.
291, 291B----------Atterberry	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
293C*:										
Chelsea------------	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
Lamont-------------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Fayette------------	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 13.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
293E*:										
Chelsea	Very poor.	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Lamont	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Fayette	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
293F*:										
Chelsea	Very poor.	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Lamont	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
Fayette	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.
315*:										
Loamy alluvial land.										
Spillville	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
320 Arenzville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
350B Waukegan	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
350C Waukegan	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
352B Whittier	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
352C2 Whittier	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
354*. Marsh										
377B Dinsdale	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
377C, 377C2 Dinsdale	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
382 Maxfield	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
412E Sogn	Very poor.	Very poor.	Poor	---	---	Very poor.	Very poor.	Very poor.	---	Very poor.
420B Tama	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
428B Ely	Good	Good	Good	Good	Good	Fair	Very poor.	Good	Good	Poor.
442C*:										
Dickinson	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.

See footnote at end of table.

TABLE 13.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
442C*:										
Tama	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
462B Downs	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
463B Fayette	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
467 Radford	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
478G*:										
Rock outcrop.										
Sogn	Very poor.	Very poor.	Poor	---	---	Very poor.	Very poor.	Very poor.	---	Very poor.
485 Spillville	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
536 Hanlon	Good	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor.
729B*:										
Nodaway	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Good	Fair.
Arenzville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
760 Ansgar	Fair	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
761 Franklin	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
771B Waubeek	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
933 Sawmill	Good	Good	Good	Fair	Fair	Poor	Poor	Good	Fair	Poor.
977 Richwood	Good	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
1119 Muscatine	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
1133 Colo	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
1160 Walford	Fair	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
1220 Nodaway	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Good	Fair.
1291 Atterberry	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.

* See map unit description for the composition and behavior of the map unit.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
8B----------------- Judson	0-8	Silt loam-------	CL, CL-ML	A-6, A-7, A-4	0	100	100	100	95-100	25-50	5-25
	8-61	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-7, A-4	0	100	100	100	95-100	25-50	5-25
11B*:											
Colo---------------	0-33	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	33-43	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	43-60	Silty clay loam, clay loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
Ely----------------	0-8	Silt loam-------	CL, OL, OH, MH	A-7, A-6	0	100	100	95-100	95-100	30-55	10-25
	8-63	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	95-100	95-100	35-50	10-25
41B, 41C, 41E------ Sparta	0-28	Loamy fine sand	SM, ML	A-2, A-4	0	100	100	60-90	20-55	---	NP
	28-64	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3, A-4	0	100	100	60-95	5-50	---	NP
63B, 63C, 63E------ Chelsea	0-5	Loamy fine sand	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
	5-62	Fine sand, sand, loamy sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
65D2, 65E2, 65F2--- Lindley	0-7	Loam------------	CL-ML, CL	A-4, A-6	0	95-100	90-100	85-95	50-75	15-30	5-15
	7-36	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	85-95	55-75	30-45	15-25
	36-60	Loam, clay loam	CL	A-6	0	95-100	90-100	85-95	50-70	30-40	15-25
83B, 83C, 83C2----- Kenyon	0-18	Loam------------	CL	A-6	0	100	95-100	85-95	65-75	30-40	10-20
	18-60	Loam, clay loam	CL	A-6	0-5	90-95	85-95	80-90	50-65	30-40	10-20
	60-70	Loam------------	CL	A-6	0-5	90-95	85-95	80-90	50-65	25-35	10-20
88----------------- Nevin	0-16	Silty clay loam	CL, OL	A-6, A-7	0	100	100	100	90-95	35-45	10-20
	16-58	Silty clay loam	CL	A-7	0	100	100	95-100	90-95	40-50	20-30
	58-68	Silty clay loam	CL	A-7	0	100	100	95-100	90-95	40-50	20-30
110C, 110E--------- Lamont	0-9	Fine sandy loam	SM-SC, SC	A-2, A-4	0	100	100	80-95	25-50	15-25	5-10
	9-32	Fine sandy loam, loam, sandy clay loam.	SM-SC, SC	A-2, A-4	0	100	100	85-95	30-50	20-30	5-10
	32-65	Loamy fine sand, loamy sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	70-90	5-25	---	NP
118---------------- Garwin	0-14	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-55	20-30
	14-39	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-55	25-35
	39-60	Silt loam-------	CL	A-6	0	100	100	100	95-100	30-40	15-20
119, 119B---------- Muscatine	0-8	Silt loam-------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	8-48	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	48-60	Silt loam-------	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
120, 120B, 120C, 120C2, 120D2------ Tama	0-6	Silt loam-------	ML, OL	A-6, A-7	0	100	100	100	95-100	35-50	10-20
	6-45	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	45-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
121---------------- Tama Variant	0-15	Silt loam-------	CL, OL	A-6, A-7	0	100	100	100	95-100	35-45	11-20
	15-40	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
	40-60	Silt loam-------	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
122----------------- Sperry	0-18	Silt loam-------	CL	A-6	0	100	100	100	95-100	30-40	10-20
	18-44	Silty clay loam, silty clay.	CH	A-7	0	100	100	100	95-100	50-65	25-35
	44-66	Silty clay loam, silt loam.	CL	A-7	0	100	100	100	95-100	40-50	20-30
133----------------- Colo	0-33	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	33-43	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	43-60	Silty clay loam, clay loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
133+---------------- Colo	0-10	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
	10-43	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	43-60	Silty clay loam, clay loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
143----------------- Brady	0-13	Sandy loam------	SM, SM-SC	A-2, A-4	0-5	95-100	75-100	60-70	25-40	<25	NP-7
	13-20	Sandy loam, sandy clay loam, loam.	SM, SC, SM-SC	A-2, A-4, A-6	0-5	95-100	75-95	60-80	25-45	15-35	NP-16
	20-38	Loamy sand, sandy loam.	SM	A-2	0-5	95-100	75-95	55-70	15-35	---	NP
	38-60	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-5	40-75	35-70	20-55	0-10	---	NP
160----------------- Walford	0-6	Silt loam-------	CL	A-6	0	100	100	100	95-100	30-35	10-15
	6-22	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	22-60	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-55	20-30
	60-65	Silt loam-------	CL	A-6	0	100	100	100	95-100	35-40	15-20
162B, 162C, 162C2, 162D2------------- Downs	0-11	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	11-49	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	15-25
	49-71	Silt loam-------	CL	A-6	0	100	100	100	95-100	30-40	10-20
163B, 163C, 163C2, 163D, 163D2------- Fayette	0-11	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	11-58	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	58-68	Silt loam-------	CL	A-6	0	100	100	100	95-100	30-40	10-20
163D3--------------- Fayette	0-11	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-45	15-25
	11-58	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	58-68	Silt loam-------	CL	A-6	0	100	100	100	95-100	30-40	10-20
163E---------------- Fayette	0-11	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	11-58	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	58-68	Silt loam-------	CL	A-6	0	100	100	100	95-100	30-40	10-20
163E3--------------- Fayette	0-11	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-45	15-25
	11-58	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	58-68	Silt loam-------	CL	A-6	0	100	100	100	95-100	30-40	10-20
163F, 163F2, 163G-- Fayette	0-11	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	11-58	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	58-68	Silt loam-------	CL	A-6	0	100	100	100	95-100	30-40	10-20
171B, 171C2, 171D2- Bassett	0-18	Loam------------	CL, CL-ML	A-4, A-6	0	100	95-100	85-95	65-85	20-30	5-15
	18-46	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-95	80-90	50-65	30-40	10-20
	46-66	Loam------------	CL	A-6	2-5	90-95	85-95	80-90	50-65	30-40	10-20

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
175B, 175C--------- Dickinson	0-18	Fine sandy loam	SM, SC, SM-SC	A-4, A-2	0	100	100	85-95	30-50	15-30	NP-10
	18-33	Fine sandy loam, sandy loam.	SM, SC, SM-SC	A-4	0	100	100	85-95	35-50	15-30	NP-10
	33-40	Loamy sand, loamy fine sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	80-95	5-20	10-20	NP-5
	40-60	Sand, fine sand	SM, SP-SM	A-3, A-2	0	100	100	70-90	5-20	---	NP
177---------------- Saude	0-17	Loam------------	CL	A-6	0	100	90-100	70-90	50-75	25-35	10-15
	17-29	Loam, sandy loam	CL, SC, CL-ML, SM-SC	A-4, A-6	0-5	85-95	80-95	70-85	36-60	20-30	5-15
	29-60	Loamy sand, gravelly coarse sand, sand.	SW, SM, GP, GM	A-1	2-10	50-90	50-85	20-40	3-25	---	NP
184---------------- Klinger	0-9	Silt loam-------	CL, ML	A-7	0	100	100	100	95-100	40-50	15-25
	9-39	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	39-60	Loam, clay loam	CL	A-6	0-5	90-95	85-90	75-85	55-65	25-35	10-20
212---------------- Kennebec	0-55	Silt loam-------	CL	A-6, A-7	0	100	100	95-100	90-100	25-45	10-20
	55-71	Loam------------	CL, CL-ML	A-6, A-4	0	90-95	85-90	75-85	55-70	25-40	5-15
214D--------------- Rockton	0-14	Loam------------	ML, CL-ML, CL	A-4, A-6	0	90-100	90-100	85-95	50-85	25-35	5-15
	14-27	Loam, sandy clay loam, clay loam.	CL, SC	A-6, A-7	0	90-100	90-100	75-90	45-70	30-45	10-20
	27-29	Clay, clay loam, silty clay.	CH, CL	A-7	0-2	90-100	90-100	90-95	70-90	40-60	20-35
	29	Weathered bedrock.									
220---------------- Nodaway	0-60	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
221---------------- Palms	0-29	Sapric material	Pt	---	---	---	---	---	---	---	---
	29-60	Loam, silty clay loam, silt loam.	CL-ML, CL	A-4, A-6	0	85-100	80-100	70-95	50-90	25-40	5-20
291, 291B---------- Atterberry	0-16	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
	16-48	Silty clay loam	CL, CH	A-7	0	100	100	95-100	95-100	40-55	20-30
	48-62	Silt loam-------	CL	A-6, A-4	0	100	100	95-100	95-100	35-40	10-20
293C*, 293E*, 293F*:											
Chelsea-----------	0-5	Loamy fine sand	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
	5-62	Fine sand, sand, loamy sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
Lamont------------	0-9	Fine sandy loam	SM-SC, SC	A-2, A-4	0	100	100	80-95	25-50	15-25	5-10
	9-32	Fine sandy loam, loam, sandy clay loam.	SM-SC, SC	A-2, A-4	0	100	100	85-95	30-50	20-30	5-10
	32-65	Loamy fine sand, loamy sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	70-90	5-25	---	NP
Fayette-----------	0-11	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	11-58	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	58-68	Silt loam-------	CL	A-6	0	100	100	100	95-100	30-40	10-20
315*: Loamy alluvial land.											

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
315*:											
Spillville--------	0-40	Loam------------	CL	A-6	0	100	95-100	85-95	60-80	25-40	10-20
	40-60	Sandy clay loam, loam, sandy loam, loamy sand.	CL, CL-ML, SM-SC, SC, SM	A-6, A-4, A-2	0	100	95-100	70-90	25-75	10-40	2-15
320---------------- Arenzville	0-28	Silt loam-------	ML, CL-ML	A-4	0	100	100	95-100	80-90	25-35	5-10
	28-60	Silt loam, silty clay loam.	ML, CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-20
350B, 350C--------- Waukegan	0-18	Silt loam-------	ML	A-4	0	95-100	95-100	95-100	85-95	25-40	3-10
	18-37	Silt loam, silty clay loam, loam.	CL-ML, CL	A-4, A-6	0	95-100	85-100	75-100	60-95	25-40	5-15
	37-60	Gravelly coarse sand, loamy sand.	SP, SW, SP-SM	A-1	0-2	80-95	65-85	30-50	3-10	---	NP
352B, 352C2-------- Whittier	0-9	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	100	95-100	85-95	25-35	5-15
	9-28	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-95	35-45	15-25
	28-36	Loam, sandy clay loam.	CL, SC	A-6	0	100	95-100	80-90	45-75	25-40	8-20
	36-60	Loamy fine sand, fine sand, loamy sand.	SM, SM-SC, SP-SM	A-2, A-3	0	100	95-100	80-90	5-20	<20	NP-5
354*. Marsh											
377B, 377C, 377C2-- Dinsdale	0-11	Silt loam-------	ML, CL, OL	A-6, A-7	0	100	100	100	95-100	30-50	10-20
	11-29	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	29-70	Loam, clay loam, sandy clay loam.	CL	A-6	0-5	90-95	85-90	75-85	55-65	25-35	10-20
382---------------- Maxfield	0-23	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-55	20-30
	23-45	Silty clay loam, silt loam.	CH, CL	A-7	0	100	100	100	95-100	45-55	25-35
	45-70	Loam------------	CL	A-6	0-5	90-95	85-90	75-85	55-65	25-35	10-20
412E--------------- Sogn	0-12	Loam------------	CL	A-6, A-7	0-10	85-100	85-100	85-100	80-95	25-45	11-23
	12	Unweathered bedrock.									
420B--------------- Tama	0-13	Silt loam-------	ML, OL	A-6, A-7	0	100	100	100	95-100	35-50	10-20
	13-45	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	45-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
428B--------------- Ely	0-8	Silt loam-------	CL, OL, OH, MH	A-7, A-6	0	100	100	95-100	95-100	30-55	10-25
	8-63	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	95-100	95-100	35-50	10-25
442C*:											
Dickinson---------	0-18	Fine sandy loam	SM, SC, SM-SC	A-4, A-2	0	100	100	85-95	30-50	15-30	NP-10
	18-33	Fine sandy loam, sandy loam.	SM, SC, SM-SC	A-4	0	100	100	85-95	35-50	15-30	NP-10
	33-40	Loamy sand, loamy fine sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	80-95	5-20	10-20	NP-5
	40-60	Sand, fine sand	SM, SP-SM	A-3, A-2	0	100	100	70-90	5-20	---	NP
Tama--------------	0-6	Silt loam-------	ML, OL	A-6, A-7	0	100	100	100	95-100	35-50	10-20
	6-45	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	45-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
462B----------------- Downs	0-11	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	11-49	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	15-25
	49-71	Silt loam-------	CL	A-6	0	100	100	100	95-100	30-40	10-20
463B----------------- Fayette	0-11	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	11-58	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	58-68	Silt loam-------	CL	A-6	0	100	100	100	95-100	30-40	10-20
467----------------- Radford	0-26	Silt loam-------	ML, CL	A-4, A-6	0	100	100	95-100	80-100	30-40	5-15
	26-66	Silty clay loam, clay loam, loam.	CL	A-6, A-7	0	100	100	95-100	80-95	35-50	15-25
478G*: Rock outcrop.											
Sogn---------------	0-12	Loam, silt loam, clay loam.	CL	A-6, A-7	0-10	85-100	85-100	85-100	80-95	25-45	11-23
	12	Unweathered bedrock.									
485----------------- Spillville	0-40	Loam------------	CL	A-6	0	100	95-100	85-95	60-80	25-40	10-20
	40-60	Loam, sandy loam, loamy sand.	CL, CL-ML, SM-SC, SC, SM	A-6, A-2, A-4	0	100	95-100	70-90	25-75	10-40	2-15
536----------------- Hanlon	0-42	Fine sandy loam	SM-SC, SC, SM	A-4	0	100	100	75-80	35-50	25-35	5-10
	42-60	Sandy loam, fine sandy loam, loamy fine sand.	SM-SC, SC	A-4, A-2-4	0	100	100	75-80	25-40	15-25	5-10
729B*: Nodaway-----------	0-60	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
Arenzville---------	0-28	Silt loam-------	ML, CL-ML	A-4	0	100	100	95-100	80-90	25-35	5-10
	28-60	Silt loam, silty clay loam.	ML, CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-20
760----------------- Ansgar	0-19	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	19-40	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	40-60	Loam, sandy clay loam.	CL	A-6	2-5	90-95	85-95	75-85	55-65	25-35	10-20
761----------------- Franklin	0-16	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	16-37	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	37-62	Loam, clay loam, sandy clay loam.	CL	A-6	0-5	90-95	85-90	75-85	55-65	25-35	10-20
771B----------------- Waubeek	0-13	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	13-29	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	29-70	Sandy clay loam, clay loam, loam.	CL	A-6	0-5	90-95	85-95	75-85	50-65	25-35	10-20
933----------------- Sawmill	0-45	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	80-100	30-50	15-30
	45-60	Silt loam-------	CL	A-6	0	100	100	95-100	80-100	25-40	10-20
977----------------- Richwood	0-19	Silt loam-------	ML	A-4	0	100	100	90-100	85-95	25-35	3-10
	19-68	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	85-95	20-30	5-12
1119----------------- Muscatine	0-8	Silt loam-------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	8-48	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	48-60	Silt loam-------	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1133---------------- Colo	0-33	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	33-43	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	43-60	Silty clay loam, clay loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
1160---------------- Walford	0-6	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-35	10-15
	6-22	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	22-60	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-55	20-30
	60-65	Silt loam--------	CL	A-6	0	100	100	100	95-100	35-40	15-20
1220---------------- Nodaway	0-60	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
1291---------------- Atterberry	0-16	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
	16-48	Silty clay loam	CL, CH	A-7	0	100	100	95-100	95-100	40-55	20-30
	48-62	Silt loam--------	CL	A-6, A-4	0	100	100	95-100	95-100	35-40	10-20

* See map unit description for the composition and behavior of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means greater than. The erosion tolerance factor (T) is for the entire profile. Wind erodibility group is for the surface layer. Absence of an entry means data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH				
8B----------------- Judson	0-8	0.6-2.0	0.21-0.23	6.1-7.3	Moderate------	0.28	5	7
	8-61	0.6-2.0	0.21-0.23	5.6-7.8	Moderate------	0.43		
11B*:								
Colo------------	0-33	0.6-2.0	0.21-0.23	5.6-7.3	High----------	0.28	5	7
	33-43	0.6-2.0	0.18-0.20	6.1-7.3	High----------	0.28		
	43-60	0.6-2.0	0.18-0.20	6.1-7.3	High----------	0.28		
Ely-------------	0-8	0.6-2.0	0.21-0.23	5.6-7.3	Moderate------	0.32	5	7
	8-63	0.6-2.0	0.18-0.20	6.1-7.3	Moderate------	0.43		
41B, 41C, 41E---- Sparta	0-28	6.0-20	0.06-0.11	5.1-7.3	Low-----------	0.17	5	2
	28-64	6.0-20	0.06-0.11	5.1-6.5	Low-----------	0.17		
63B, 63C, 63E---- Chelsea	0-5	6.0-20	0.10-0.15	5.6-7.3	Low-----------	0.17	5	2
	5-62	6.0-20	0.06-0.08	5.1-5.5	Low-----------	0.17		
65D2, 65E2, 65F2- Lindley	0-7	0.6-2.0	0.16-0.18	4.5-6.0	Low-----------	0.32	5	6
	7-36	0.2-0.6	0.14-0.18	4.5-6.5	Moderate------	0.32		
	36-60	0.2-0.6	0.12-0.16	6.1-7.8	Moderate------	0.32		
83B, 83C, 83C2--- Kenyon	0-18	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.28	5	6
	18-60	0.6-2.0	0.17-0.19	5.1-7.3	Low-----------	0.28		
	60-70	0.6-2.0	0.17-0.19	6.6-7.8	Low-----------	0.37		
88--------------- Nevin	0-16	0.6-2.0	0.21-0.23	5.6-7.3	Moderate------	0.32	5	7
	16-58	0.6-2.0	0.18-0.20	5.6-6.5	Moderate------	0.43		
	58-68	0.6-2.0	0.18-0.20	6.6-7.3	Moderate------	0.43		
110C, 110E------- Lamont	0-9	2.0-6.0	0.16-0.18	5.1-7.3	Low-----------	0.24	5	3
	9-32	2.0-6.0	0.14-0.16	4.5-6.0	Low-----------	0.24		
	32-65	>20	0.09-0.11	5.1-6.5	Low-----------	0.17		
118-------------- Garwin	0-14	0.2-0.6	0.21-0.23	5.6-7.3	High----------	0.28	5	7
	14-39	0.2-0.6	0.18-0.20	6.1-7.3	High----------	0.28		
	39-60	0.6-2.0	0.20-0.22	6.6-7.8	Moderate------	0.28		
119, 119B-------- Muscatine	0-8	0.6-2.0	0.22-0.24	5.1-7.3	Moderate------	0.28	5	6
	8-48	0.6-2.0	0.18-0.20	5.1-7.3	Moderate------	0.43		
	48-60	0.6-2.0	0.18-0.20	6.6-7.8	Moderate------	0.43		
120, 120B, 120C, 120C2, 120D2---- Tama	0-6	0.6-2.0	0.22-0.24	5.1-7.3	Moderate------	0.32	5	7
	6-45	0.6-2.0	0.18-0.20	5.1-6.0	Moderate------	0.43		
	45-60	0.6-2.0	0.18-0.20	5.6-7.3	Moderate------	0.43		
121-------------- Tama Variant	0-15	0.6-2.0	0.22-0.24	5.1-6.5	Moderate------	0.32	5	6
	15-40	0.6-2.0	0.18-0.20	5.1-6.0	Moderate------	0.43		
	40-60	0.6-2.0	0.18-0.20	5.6-6.0	Moderate------	0.43		
122-------------- Sperry	0-18	0.6-2.0	0.22-0.24	5.6-7.3	Moderate------	0.28	5	6
	18-44	<0.2	0.14-0.16	5.1-6.5	Hign----------	0.43		
	44-66	0.2-0.6	0.19-0.21	5.6-6.5	High----------	0.43		
133-------------- Colo	0-33	0.6-2.0	0.21-0.23	5.6-7.3	High----------	0.28	5	7
	33-43	0.6-2.0	0.18-0.20	6.1-7.3	High----------	0.28		
	43-60	0.6-2.0	0.18-0.20	6.1-7.3	High----------	0.28		
133+------------- Colo	0-12	0.6-2.0	0.22-0.24	6.6-7.3	Moderate------	0.28	5	6
	12-43	0.6-2.0	0.18-0.20	6.1-7.3	High----------	0.28		
	43-60	0.6-2.0	0.18-0.20	6.1-7.3	High----------	0.28		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
						K	T	
	In	In/hr	In/in	pH				
143------------- Brady	0-13	2.0-6.0	0.12-0.15	5.6-7.3	Low-----------	0.20	5	3
	13-20	2.0-6.0	0.12-0.17	5.1-6.5	Low-----------	0.20		
	20-38	2.0-20	0.08-0.10	5.1-6.5	Low-----------	0.20		
	38-60	>20	0.02-0.04	6.6-8.4	Low-----------	0.10		
160------------- Walford	0-6	0.6-2.0	0.21-0.23	5.6-7.3	Moderate------	0.32	5	6
	6-22	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.43		
	22-60	0.06-0.2	0.18-0.20	5.1-6.0	High----------	0.43		
	60-65	0.6-2.0	0.20-0.22	5.6-7.8	Moderate------	0.43		
162B, 162C, 162C2, 162D2---- Downs	0-11	0.6-2.0	0.21-0.23	5.1-7.3	Low-----------	0.32	5	6
	11-49	0.6-2.0	0.18-0.20	4.5-6.0	Moderate------	0.43		
	49-71	0.6-2.0	0.18-0.20	5.6-6.6	Moderate------	0.43		
163B, 163C, 163C2, 163D, 163D2---------- Fayette	0-11	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.37	5	6
	11-58	0.6-2.0	0.18-0.20	4.5-6.0	Moderate------	0.37		
	58-68	0.6-2.0	0.18-0.20	5.1-6.5	Moderate------	0.37		
163D3----------- Fayette	0-11	0.6-2.0	0.18-0.20	5.1-7.3	Moderate------	0.37	4	7
	11-58	0.6-2.0	0.18-0.20	4.5-6.0	Moderate------	0.37		
	58-68	0.6-2.0	0.18-0.20	5.1-6.5	Moderate------	0.37		
163E------------ Fayette	0-11	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.37	5	6
	11-58	0.6-2.0	0.18-0.20	4.5-6.0	Moderate------	0.37		
	58-68	0.6-2.0	0.18-0.20	5.1-6.5	Moderate------	0.37		
163E3----------- Fayette	0-11	0.6-2.0	0.18-0.20	5.1-7.3	Moderate------	0.37	4	7
	11-58	0.6-2.0	0.18-0.20	4.5-6.0	Moderate------	0.37		
	58-68	0.6-2.0	0.18-0.20	5.1-6.5	Moderate------	0.37		
163F, 163F2, 163G----------- Fayette	0-11	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.37	5	6
	11-58	0.6-2.0	0.18-0.20	4.5-6.0	Moderate------	0.37		
	58-68	0.6-2.0	0.18-0.20	5.1-6.5	Moderate------	0.37		
171B, 171C2, 171D2---------- Bassett	0-18	0.6-2.0	0.19-0.21	5.1-6.5	Low-----------	0.28	5	6
	18-46	0.6-2.0	0.17-0.19	4.5-6.0	Low-----------	0.28		
	46-66	0.6-2.0	0.17-0.19	5.1-7.8	Low-----------	0.37		
175B, 175C------- Dickinson	0-18	2.0-6.0	0.12-0.15	5.6-7.3	Low-----------	0.20	4	3
	18-33	2.0-6.0	0.12-0.15	5.6-6.5	Low-----------	0.20		
	33-40	6.0-20	0.08-0.10	5.6-6.5	Low-----------	0.20		
	40-60	6.0-20	0.02-0.04	5.6-6.5	Low-----------	0.15		
177------------- Saude	0-17	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.28	4	5
	17-29	0.6-6.0	0.15-0.19	5.1-6.0	Low-----------	0.28		
	29-60	>20	0.02-0.06	5.1-6.5	Very low------	0.10		
184------------- Klinger	0-9	0.6-2.0	0.22-0.24	5.1-7.3	Moderate------	0.32	5	6
	9-39	0.6-2.0	0.18-0.20	5.1-6.5	Moderate------	0.43		
	39-60	0.6-2.0	0.17-0.19	5.6-7.8	Low-----------	0.43		
212------------- Kennebec	0-55	0.6-2.0	0.22-0.24	5.6-7.3	Moderate------	0.32	5	6
	55-71	0.6-2.0	0.20-0.22	6.1-7.3	Moderate------	0.43		
214D------------ Rockton	0-14	0.6-2.0	0.20-0.22	5.1-6.5	Low-----------	0.28	4	6
	14-27	0.6-2.0	0.17-0.19	5.1-6.5	Moderate------	0.28		
	27-29	0.6-2.0	0.10-0.14	5.6-7.3	High----------	0.28		
	29							
220------------- Nodaway	0-60	0.6-2.0	0.20-0.23	6.1-7.3	Moderate------	0.37	5	7

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH				
221---------------- Palms	0-29	2.0-6.0	0.35-0.45	5.1-8.4	-------------	---	---	3
	29-61	0.6-2.0	0.14-0.22	6.1-8.4	Low-----------	---		
291, 291B-------- Atterberry	0-16	0.6-2.0	0.22-0.24	5.6-6.5	Low-----------	0.32	5	6
	16-48	0.2-2.0	0.18-0.20	5.1-6.0	Moderate------	0.43		
	48-62	0.6-2.0	0.20-0.22	6.1-7.8	Low-----------	0.43		
293C*, 293E*, 293F*:								
Chelsea--------	0-5	6.0-20	0.10-0.15	5.6-7.3	Low-----------	0.17	5	2
	5-62	6.0-20	0.06-0.08	5.1-5.5	Low-----------	0.17		
Lamont---------	0-9	2.0-6.0	0.16-0.18	5.1-7.3	Low-----------	0.24	5	3
	9-32	2.0-6.0	0.14-0.16	5.1-6.0	Low-----------	0.24		
	32-65	>20	0.09-0.11	5.1-6.5	Low-----------	0.17		
Fayette--------	0-11	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.37	5	6
	11-58	0.6-2.0	0.18-0.20	4.5-6.0	Moderate------	0.37		
	58-68	0.6-2.0	0.18-0.20	5.1-6.5	Moderate------	0.37		
315*: Loamy alluvial land.								
Spillville------	0-40	0.6-2.0	0.19-0.21	5.6-7.3	Moderate------	0.28	5	6
	40-60	0.6-6.0	0.15-0.18	5.6-7.3	Low-----------	0.28		
320-------------- Arenzville	0-28	0.6-2.0	0.20-0.24	5.6-7.8	Low-----------	0.37	5	5
	28-60	0.6-2.0	0.18-0.22	5.6-7.8	Moderate------	0.37		
350B, 350C------- Waukegan	0-18	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.32	4	6
	18-37	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.43		
	37-60	6.0-20	0.02-0.04	6.6-7.8	Low-----------	0.10		
352B, 352C2------ Whittier	0-9	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.32	4	6
	9-28	0.6-2.0	0.17-0.19	5.1-6.5	Moderate------	0.43		
	28-36	0.6-2.0	0.16-0.18	5.1-6.0	Low-----------	0.43		
	36-60	6.0-20	0.04-0.07	5.1-6.5	Low-----------	0.17		
354*. Marsh								
377B, 377C, 377C2----------- Dinsdale	0-11	0.6-2.0	0.21-0.23	5.1-7.3	Moderate------	0.32	5	7
	11-29	0.6-2.0	0.18-0.20	5.1-6.0	Moderate------	0.43		
	29-70	0.6-2.0	0.17-0.19	5.6-8.4	Low-----------	0.43		
382-------------- Maxfield	0-23	0.6-2.0	0.21-0.23	6.6-7.3	High----------	0.24	5	6
	23-45	0.6-2.0	0.18-0.20	6.1-7.3	High----------	0.32		
	45-70	0.6-2.0	0.17-0.19	6.1-7.8	Low-----------	0.32		
412E------------- Sogn	0-12	0.6-2.0	0.17-0.22	6.1-8.4	Moderate------	0.28	1	4L
	12							
420B------------- Tama	0-6	0.6-2.0	0.22-0.24	5.1-7.3	Moderate------	0.32	5	7
	6-45	0.6-2.0	0.18-0.20	5.1-6.0	Moderate------	0.43		
	45-60	0.6-2.0	0.18-0.20	5.6-7.3	Moderate------	0.43		
428B------------- Ely	0-8	0.6-2.0	0.21-0.23	5.6-7.3	Moderate------	0.32	5	7
	8-63	0.6-2.0	0.18-0.20	6.1-7.3	Moderate------	0.43		
442C*:								
Dickinson-------	0-18	2.0-6.0	0.12-0.15	5.6-6.5	Low-----------	0.20	4	3
	18-33	2.0-6.0	0.12-0.15	5.6-6.5	Low-----------	0.20		
	33-40	6.0-20	0.08-0.10	5.6-6.5	Low-----------	0.20		
	40-60	6.0-20	0.02-0.04	5.6-6.5	Low-----------	0.15		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH				
442C*:								
Tama-----------	0-13	0.6-2.0	0.22-0.24	5.1-7.3	Moderate------	0.32	5	7
	13-45	0.6-2.0	0.18-0.20	5.1-6.0	Moderate------	0.43		
	45-60	0.6-2.0	0.18-0.20	5.6-7.3	Moderate------	0.43		
462B------------- Downs	0-11	0.6-2.0	0.21-0.23	5.1-7.3	Low-----------	0.32	5	6
	11-49	0.6-2.0	0.18-0.20	4.5-6.0	Moderate------	0.43		
	49-71	0.6-2.0	0.18-0.20	5.6-6.6	Moderate------	0.43		
463B------------- Fayette	0-11	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.37	5	6
	11-58	0.6-2.0	0.18-0.20	4.5-6.0	Moderate------	0.37		
	58-68	0.6-2.0	0.18-0.20	5.1-6.5	Moderate------	0.37		
467-------------- Radford	0-26	0.6-2.0	0.22-0.24	6.1-7.8	Low-----------	0.28	5	6
	26-66	0.6-2.0	0.18-0.20	6.6-7.8	Moderate------	0.28		
478G*:								
Rock outcrop.								
Sogn------------	0-12	0.6-2.0	0.17-0.22	6.1-8.4	Moderate------	0.28	1	4L
	12							
485-------------- Spillville	0-40	0.6-2.0	0.19-0.21	5.6-7.3	Moderate------	0.28	5	6
	40-60	0.6-6.0	0.15-0.18	5.6-7.3	Low-----------	0.28		
536-------------- Hanlon	0-42	2.0-6.0	0.16-0.18	6.6-7.3	Low-----------	0.20	5	3
	42-60	2.0-6.0	0.11-0.13	5.6-7.3	Low-----------	0.20		
729B*:								
Nodaway---------	0-60	0.6-2.0	0.20-0.23	6.1-7.3	Moderate------	0.37	5	7
Arenzville------	0-28	0.6-2.0	0.20-0.24	5.6-7.8	Low-----------	0.37	---	5
	28-60	0.6-2.0	0.18-0.22	5.6-7.8	Moderate------	0.37		
760-------------- Ansgar	0-19	0.6-2.0	0.21-0.23	5.6-6.0	Moderate------	0.32	5	6
	19-40	0.6-2.0	0.18-0.20	5.1-6.0	High----------	0.43		
	40-60	0.6-2.0	0.17-0.19	5.6-6.5	Low-----------	0.43		
761-------------- Franklin	0-16	0.6-2.0	0.21-0.23	4.5-7.3	Moderate------	0.32	5	6
	16-37	0.6-2.0	0.18-0.20	4.5-6.0	Moderate------	0.43		
	37-62	0.6-2.0	0.17-0.19	5.1-7.8	Low-----------	0.43		
771B-------------	0-13	2.0-6.0	0.21-0.23	5.6-7.3	Moderate------	0.32	5	6
	13-29	0.6-2.0	0.18-0.20	5.6-6.0	Moderate------	0.32		
Waubeek	29-70	0.6-2.0	0.17-0.19	5.1-7.3	Low-----------	0.43		
933-------------- Sawmill	0-45	0.6-2.0	0.18-0.23	6.1-7.8	Moderate------	0.28	5	7
	45-60	0.6-2.0	0.11-0.20	7.4-8.4	Moderate------	0.28		
977-------------- Richwood	0-19	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.28	5	5
	19-68	0.6-2.0	0.18-0.22	5.6-7.3	Low-----------	0.43		
1119------------- Muscatine	0-8	0.6-2.0	0.22-0.24	5.1-7.3	Moderate------	0.28	5	6
	8-48	0.6-2.0	0.18-0.20	5.1-7.3	Moderate------	0.43		
	48-60	0.6-2.0	0.18-0.20	6.6-7.8	Moderate------	0.43		
1133------------- Colo	0-33	0.6-2.0	0.21-0.23	5.6-7.3	High----------	0.28	5	7
	33-43	0.6-2.0	0.18-0.20	6.1-7.3	High----------	0.28		
	43-60	0.6-2.0	0.18-0.20	6.1-7.3	High----------	0.28		
1160------------- Walford	0-6	0.6-2.0	0.21-0.23	5.6-7.3	Moderate------	0.32	5	6
	6-22	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.43		
	22-60	0.06-0.2	0.18-0.20	5.1-6.0	High----------	0.43		
	60-65	0.6-2.0	0.20-0.22	5.6-7.8	Moderate------	0.43		
1220------------- Nodaway	0-60	0.6-2.0	0.20-0.23	6.1-7.3	Moderate------	0.37	5	7

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH				
1291-------------- Atterberry	0-16	0.6-2.0	0.22-0.24	5.6-6.5	Low------------	0.32	5	6
	16-48	0.2-2.0	0.18-0.20	5.1-6.0	Moderate------	0.43		
	48-62	0.6-2.0	0.20-0.22	6.1-7.8	Low------------	0.43		

* See map unit description for the composition and behavior of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. See text for descriptions of symbols and such "brief," and "perched." The symbol < means less than; > means greater than]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potenti frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
					Ft			In		
8B----------------- Judson	B	None---------	---	---	>6.0	---	---	>60	---	High---
11B*: Colo--------------	B/D	Common-------	Very brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High---
Ely---------------	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High---
41B, 41C, 41E----- Sparta	A	None---------	---	---	>6.0	---	---	>60	---	Low----
63B, 63C, 63E----- Chelsea	A	None---------	---	---	>6.0	---	---	>60	---	Low----
65D2, 65E2, 65F2-- Lindley	C	None---------	---	---	>6.0	---	---	>60	---	Moderat
83B, 83C, 83C2---- Kenyon	B	None---------	---	---	>6.0	---	---	>60	---	Moderat
88----------------- Nevin	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High---
110C, 110E-------- Lamont	B	None---------	---	---	>6.0	---	---	>60	---	Moderat
118---------------- Garwin	B/D	None---------	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High---
119, 119B--------- Muscatine	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High---
120, 120B, 120C, 120C2, 120D2----- Tama	B	None---------	---	---	>6.0	---	---	>60	---	High---
121---------------- Tama Variant	B	None---------	---	---	>6.0	---	---	>60	---	High---
122---------------- Sperry	C/D	Frequent----	Very brief to long.	Feb-Jul	0-1.0	Apparent	Nov-Jul	>60	---	High---
133, 133+--------- Colo	B/D	Common-------	Very brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High---
143---------------- Brady	B	None---------	---	---	1.0-3.0	Apparent	Nov-May	>60	---	High---

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potenti[al] frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
					Ft			In		
160-------------- Walford	B/D	None--------	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High---
162B, 162C, 162C2, 162D2----------- Downs	B	None--------	---	---	>6.0	---	---	>60	---	High---
163B, 163C, 163C2, 163D, 163D2, 163D3, 163E, 163E3, 163F, 163F2, 163G------ Fayette	B	None--------	---	---	>6.0	---	---	>60	---	High---
171B, 171C2, 171D2----------- Bassett	B	None--------	---	---	>6.0	---	---	>60	---	Moderat
175B, 175C-------- Dickinson	B	None--------	---	---	>6.0	---	---	>60	---	Moderat
177-------------- Saude	B	None--------	---	---	>6.0	---	---	>60	---	Low----
184-------------- Klinger	B	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High---
212-------------- Kennebec	B	Common------	Brief-----	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	High---
214D------------- Rockton	B	None--------	---	---	>6.0	---	---	20-40	Rippable	Moderat
220-------------- Nodaway	B	Common------	Very brief to brief.	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	High---
221-------------- Palms	A/D	Frequent----	Long------	Nov-May	0-1.0	Apparent	Nov-May	>60	---	High---
291, 291B-------- Atterberry	B	None--------	---	---	1.0-3.0	Apparent	Nov-Jul	>60	---	High---
293C*, 293E*, 293F*:										
Chelsea---------	A	None--------	---	---	>6.0	---	---	>60	---	Low----
Lamont----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderat
Fayette---------	B	None--------	---	---	>6.0	---	---	>60	---	High---
315*: Loamy alluvial land.										

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potenti frost actior
					Ft			In		
315*:										
Spillville	B	Common	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderat
320 Arenzville	B	Frequent	Brief	Feb-Nov	3.0-6.0	Apparent	Nov-Jul	>60	---	High
350B, 350C Waukegan	B	None	---	---	>6.0	---	---	>60	---	Low
352B, 352C2 Whittier	B	None	---	---	>6.0	---	---	>60	---	Moderat
354*. Marsh										
377B, 377C, 377C2 Dinsdale	B	None	---	---	>6.0	---	---	>60	---	High
382 Maxfield	B/D	None	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High
412E Sogn	D	None	---	---	>6.0	---	---	4-20	Hard	Moderat
420B Tama	B	None	---	---	>6.0	---	---	>60	---	High
428B Ely	B	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High
442C*:										
Dickinson	B	None	---	---	>6.0	---	---	>60	---	Moderat
Tama	B	None	---	---	>6.0	---	---	>60	---	High
462B Downs	B	None	---	---	>6.0	---	---	>60	---	High
463B Fayette	B	None	---	---	>6.0	---	---	>60	---	High
467 Radford	B	Frequent	Brief	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High
478G*: Rock outcrop.										
Sogn	D	None	---	---	>6.0	---	---	4-20	Hard	Moderat
485 Spillville	B	Common	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderat
536 Hanlon	B	Common	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderat

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potenti frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
					Ft			In		
729B*:										
Nodaway----------	B	Common------	Very brief to brief.	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	High---
Arenzville-------	B	Frequent----	Brief-----	Feb-Nov	3.0-6.0	Apparent	Nov-Jul	>60	---	High---
760-------------- Ansgar	B/D	None--------	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High---
761-------------- Franklin	B	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High---
771B------------- Waubeek	B	None--------	---	---	>6.0	---	---	>60	---	High---
933-------------- Sawmill	B/D	Frequent----	Brief-----	Mar-Jun	0-2.0	Apparent	Nov-Jul	>60	---	High---
977-------------- Richwood	B	None--------	---	---	>6.0	---	---	>60	---	High---
1119------------- Muscatine	B	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High---
1133------------- Colo	B/D	Common------	Very brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High---
1160------------- Walford	B/D	None--------	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High---
1220------------- Nodaway	B	Common------	Very brief to brief.	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	High---
1291------------- Atterberry	B	None--------	---	---	1.0-3.0	Apparent	Nov-Jul	>60	---	High---

* See map unit description for the composition and behavior of the map unit.

TABLE 17.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics of this taxadjunct that are outside the range of the series]

Soil name	Family or higher taxonomic class
*Ansgar	Fine-silty, mixed, mesic Mollic Ochraqualfs
Arenzville	Coarse-silty, mixed, nonacid, mesic Typic Udifluvents
Atterberry	Fine-silty, mixed, mesic Udollic Ochraqualfs
Bassett	Fine-loamy, mixed, mesic Mollic Hapludalfs
*Brady	Coarse-loamy, mixed, mesic Aquollic Hapludalfs
Chelsea	Mixed, mesic Alfic Udipsamments
Colo	Fine-silty, mixed, mesic Cumulic Haplaquolls
Dickinson	Coarse-loamy, mixed, mesic Typic Hapludolls
Dinsdale	Fine-silty, mixed, mesic Typic Argiudolls
Downs	Fine-silty, mixed, mesic Mollic Hapludalfs
Ely	Fine-silty, mixed, mesic Cumulic Hapludolls
Fayette	Fine-silty, mixed, mesic Typic Hapludalfs
Franklin	Fine-silty, mixed, mesic Udollic Ochraqualfs
Garwin	Fine-silty, mixed, mesic Typic Haplaquolls
*Hanlon	Coarse-loamy, mixed, mesic Cumulic Hapludolls
Judson	Fine-silty, mixed, mesic Cumulic Hapludolls
Kennebec	Fine-silty, mixed, mesic Cumulic Hapludolls
Kenyon	Fine-loamy, mixed, mesic Typic Hapludolls
Klinger	Fine-silty, mixed, mesic Aquic Hapludolls
Lamont	Coarse-loamy, mixed, mesic Typic Hapludalfs
Lindley	Fine-loamy, mixed, mesic Typic Hapludalfs
*Maxfield	Fine-silty, mixed, mesic Typic Haplaquolls
Muscatine	Fine-silty, mixed, mesic Aquic Hapludolls
*Nevin	Fine-silty, mixed, mesic Aquic Argiudolls
Nodaway	Fine-silty, mixed, nonacid, mesic Mollic Udifluvents
Palms	Loamy, mixed, euic, mesic Terric Medisaprists
Radford	Fine-silty, mixed, mesic Fluvaquentic Hapludolls
*Richwood	Fine-silty, mixed, mesic Typic Argiudolls
Rockton	Fine-loamy, mixed, mesic Typic Argiudolls
Saude	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludolls
Sawmill	Fine-silty, mixed, mesic Cumulic Haplaquolls
Sogn	Loamy, mixed, mesic Lithic Haplustolls
Sparta	Sandy, mixed, mesic Entic Hapludolls
*Sperry	Fine, montmorillonitic, mesic Typic Argialbolls
Spillville	Fine-loamy, mixed, mesic Cumulic Hapludolls
Tama	Fine-silty, mixed, mesic Typic Argiudolls
Tama Variant	Fine-silty, mixed, mesic Typic Argiudolls
Walford	Fine-silty, mixed, mesic Mollic Ochraqualfs
Waubeek	Fine-silty, mixed, mesic Mollic Hapludalfs
*Waukegan	Fine-silty over sandy or sandy-skeletal, mixed, mesic Typic Hapludolls
Whittier	Fine-silty over sandy or sandy-skeletal, mixed, mesic Mollic Hapludalfs

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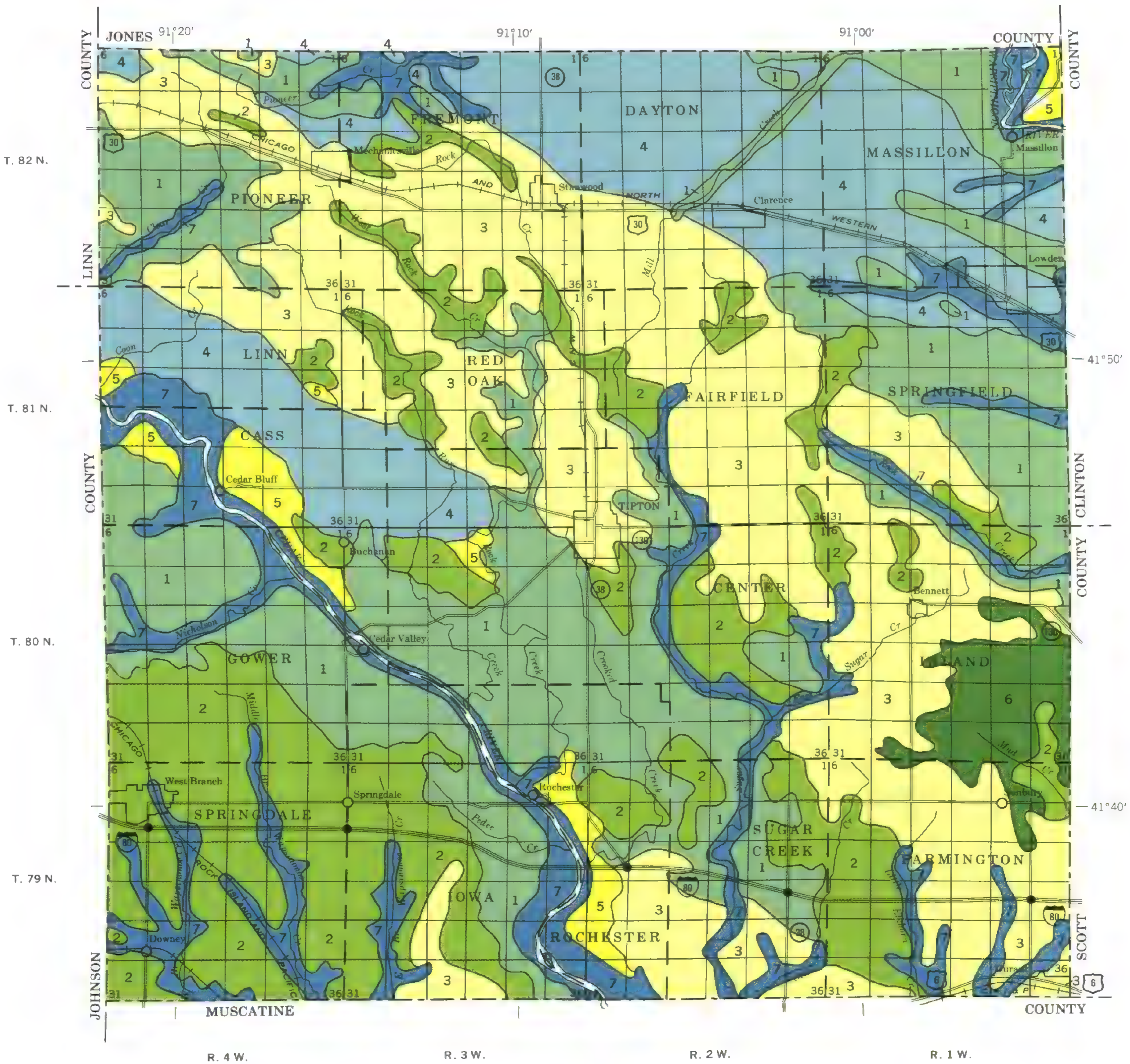


U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

IOWA AGRICULTURE AND HOME ECONOMICS EXPERIMENT STATION
COOPERATIVE EXTENSION SERVICE, IOWA STATE UNIVERSITY
DEPARTMENT OF SOIL CONSERVATION, STATE OF IOWA

GENERAL SOIL MAP

CEDAR COUNTY, IOWA

Scale 1:190,080

1 0 1 2 3 4 Miles

SOIL LEGEND

1 Fayette–Downs association: Gently sloping to very steep, well drained upland soils formed in silty material

2 Tama–Downs association: Gently sloping to strongly sloping, well drained upland soils formed in silty material

3 Tama–Muscatine association: Nearly level to moderately sloping, well drained and somewhat poorly drained upland soils formed in silty material

4 Dinsdale–Klinger association: Nearly level to moderately sloping, well drained to somewhat poorly drained upland soils formed in silty material and in the underlying glacial till

5 Chelsea–Lamont–Fayette association: Moderately sloping to very steep, well drained to excessively drained upland soils formed in silty or sandy material

6 Atterberry–Muscatine–Tama Variant association: Nearly level to gently sloping, somewhat poorly drained and moderately well drained upland soils formed in silty material

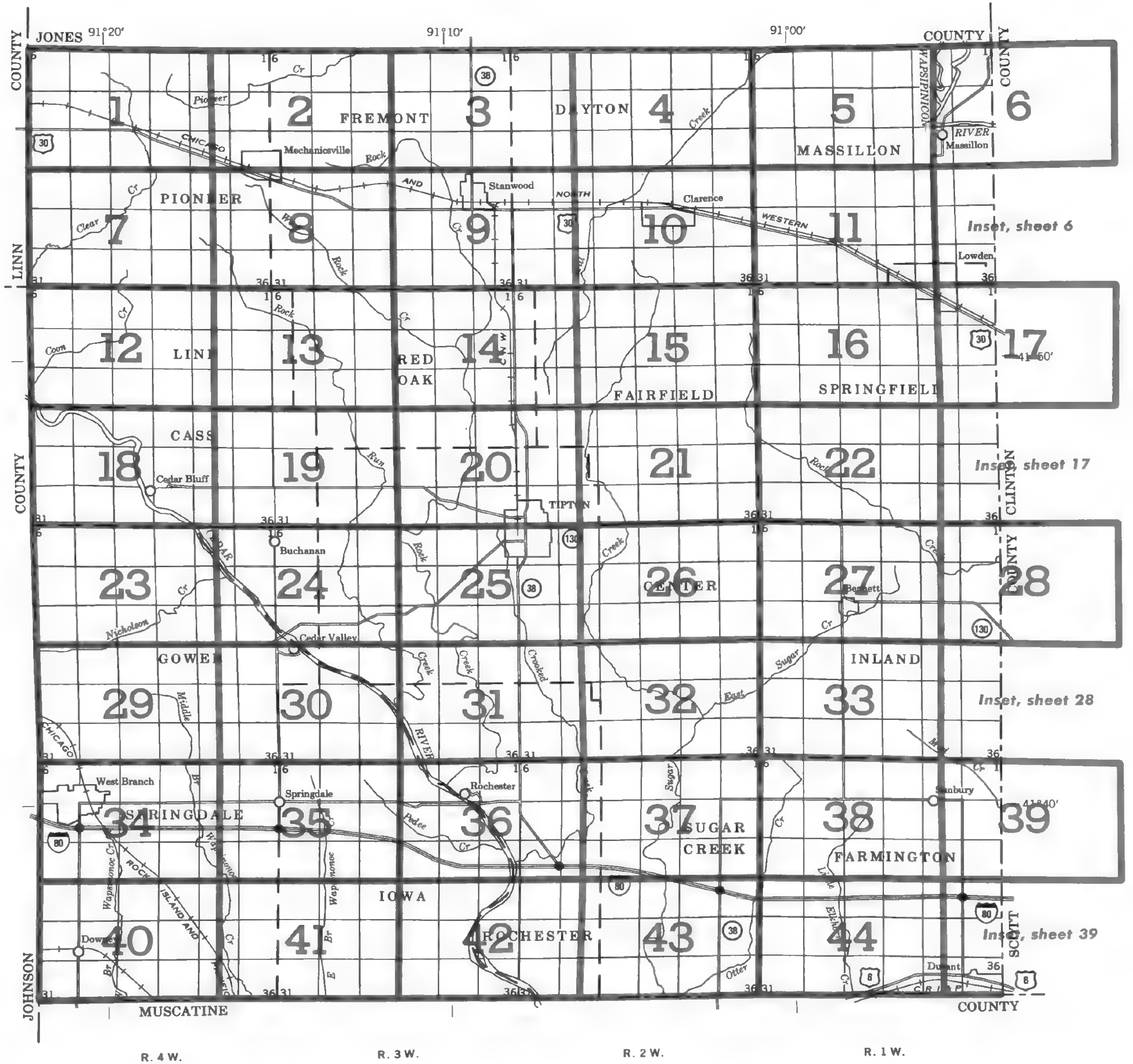
7 Colo–Sawmill–Loamy alluvial land association: Nearly level, poorly drained to well drained bottom land soils formed in silty or loamy alluvium

Compiled 1978

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36



INDEX TO MAP SHEETS

CEDAR COUNTY, IOWA

Scale 1:190,080

1 0 1 2 3 4 Miles

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

CEDAR COUNTY, IOWA

IOWA AGRICULTURE AND HOME ECONOMICS EXPERIMENT STATION
COOPERATIVE EXTENSION SERVICE, IOWA STATE UNIVERSITY
DEPARTMENT OF SOIL CONSERVATION, STATE OF IOWA

SOIL LEGEND

Symbols consist of numbers or a combination of numbers and letters; for example, 88, 120B, and 352C2. The first number designates the kind of soil or land type. A capital letter following the number indicates the class of slope. Symbols without a slope letter are for units that are nearly level. A final number 2 or 3 following a letter indicates that the soil is moderately or severely eroded.

SYMBOL	NAME
8B	Judson silt loam, 2 to 5 percent slopes
11B	Colo—Ely complex, 2 to 5 percent slopes
41B	Sparta loamy fine sand, 1 to 5 percent slopes
41C	Sparta loamy fine sand, 5 to 9 percent slopes
41E	Sparta loamy fine sand, 9 to 18 percent slopes
63B	Chelsea loamy fine sand, 2 to 5 percent slopes
63C	Chelsea loamy fine sand, 5 to 9 percent slopes
63E	Chelsea loamy fine sand, 9 to 20 percent slopes
65D2	Lindley loam, 9 to 14 percent slopes, moderately eroded
65E2	Lindley loam, 14 to 18 percent slopes, moderately eroded
65F2	Lindley loam, 18 to 25 percent slopes, moderately eroded
83B	Kenyon loam, 2 to 5 percent slopes
83C	Kenyon loam, 5 to 9 percent slopes
83C2	Kenyon loam, 5 to 9 percent slopes, moderately eroded
88	Nevin silty clay loam, 0 to 2 percent slopes
110C	Lamont fine sandy loam, 2 to 9 percent slopes
110E	Lamont fine sandy loam, 9 to 18 percent slopes
118	Garwin silty clay loam, 0 to 2 percent slopes
119	Muscatine silt loam, 0 to 2 percent slopes
119B	Muscatine silt loam, 2 to 5 percent slopes
120	Tama silt loam, 0 to 2 percent slopes
120B	Tama silt loam, 2 to 5 percent slopes
120C	Tama silt loam, 5 to 9 percent slopes
120C2	Tama silt loam, 5 to 9 percent slopes, moderately eroded
120D2	Tama silt loam, 9 to 14 percent slopes, moderately eroded
121	Tama Variant silt loam, 1 to 3 percent slopes
122	Sperry silt loam, 0 to 1 percent slopes
133	Colo silty clay loam, 0 to 2 percent slopes
133 +	Colo silt loam, overwash, 0 to 2 percent slopes
143	Brady sandy loam, 0 to 2 percent slopes
160	Walford silt loam, 0 to 1 percent slopes
162B	Downs silt loam, 2 to 5 percent slopes
162C	Downs silt loam, 5 to 9 percent slopes
162C2	Downs silt loam, 5 to 9 percent slopes, moderately eroded
162D2	Downs silt loam, 9 to 14 percent slopes, moderately eroded
163B	Fayette silt loam, 2 to 5 percent slopes
163C	Fayette silt loam, 5 to 9 percent slopes
163C2	Fayette silt loam, 5 to 9 percent slopes, moderately eroded
163D	Fayette silt loam, 9 to 14 percent slopes
163D2	Fayette silt loam, 9 to 14 percent slopes, moderately eroded
163D3	Fayette silty clay loam, 9 to 14 percent slopes, severely eroded
163E	Fayette silt loam, 14 to 18 percent slopes
163E3	Fayette silty clay loam, 14 to 18 percent slopes, severely eroded
163F	Fayette silt loam, 18 to 25 percent slopes
163F2	Fayette silt loam, 18 to 25 percent slopes, moderately eroded
163G	Fayette silt loam, 25 to 40 percent slopes
171B	Bassett loam, 2 to 5 percent slopes

SYMBOL	NAME
171C2	Bassett loam, 5 to 9 percent slopes, moderately eroded
171D2	Bassett loam, 9 to 14 percent slopes, moderately eroded
175B	Dickinson fine sandy loam, 1 to 5 percent slopes
175C	Dickinson fine sandy loam, 5 to 9 percent slopes
177	Saude loam, 1 to 3 percent slopes
184	Klinger silt loam, 1 to 3 percent slopes
212	Kennebec silt loam, 0 to 2 percent slopes
214D	Rockton loam, 20 to 30 inches to limestone, 5 to 14 percent slopes
220	Nodaway silt loam, 0 to 2 percent slopes
221	Palms muck, 1 to 3 percent slopes
291	Atterberry silt loam, 0 to 2 percent slopes
291B	Atterberry silt loam, 2 to 5 percent slopes
293C	Chelsea—Lamont—Fayette complex, 5 to 9 percent slopes
293E	Chelsea—Lamont—Fayette complex, 9 to 18 percent slopes
293F	Chelsea—Lamont—Fayette complex, 18 to 40 percent slopes
315	Loamy alluvial land—Spillville complex, 0 to 2 percent slopes
320	Arenzville silt loam, 0 to 2 percent slopes
350B	Waukegan silt loam, 2 to 5 percent slopes
350C	Waukegan silt loam, 5 to 9 percent slopes
352B	Whittier silt loam, 2 to 5 percent slopes
352C2	Whittier silt loam, 5 to 9 percent slopes, moderately eroded
354	Marsh
377B	Dinsdale silt loam, 2 to 5 percent slopes
377C	Dinsdale silt loam, 5 to 9 percent slopes
377C2	Dinsdale silt loam, 5 to 9 percent slopes, moderately eroded
382	Maxfield silty clay loam, 0 to 2 percent slopes
412E	Sogn loam, 9 to 18 percent slopes
420B	Tama silt loam, benches, 2 to 5 percent slopes
428B	Ely silt loam, 2 to 5 percent slopes
442C	Dickinson—Tama complex, 4 to 10 percent slopes
462B	Downs silt loam, benches, 2 to 5 percent slopes
463B	Fayette silt loam, benches, 2 to 5 percent slopes
467	Radford silt loam, 0 to 2 percent slopes
478G	Rock outcrop—Sogn complex, 25 to 60 percent slopes
485	Spillville loam, 0 to 2 percent slopes
536	Hanlon fine sandy loam, 0 to 2 percent slopes
729B	Nodaway—Arenzville silt loams, 2 to 5 percent slopes
760	Ansgar silt loam, 0 to 2 percent slopes
761	Franklin silt loam, 1 to 3 percent slopes
771B	Waubeek silt loam, 2 to 5 percent slopes
933	Sawmill silty clay loam, 0 to 2 percent slopes
977	Richwood silt loam, 0 to 2 percent slopes
1119	Muscatine silt loam, benches, 0 to 2 percent slopes
1133	Colo silty clay loam, channeled, 0 to 2 percent slopes
1160	Walford silt loam, benches, 0 to 1 percent slopes
1220	Nodaway silt loam, channeled, 0 to 2 percent slopes
1291	Atterberry silt loam, benches, 0 to 2 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool — Davis Airstrip; FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate — 79
- Federal — 410
- State — 52
- County, farm or ranch — 378

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water; w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — GAS
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water; w
- Intermittent — int; i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — 41; 993E2

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

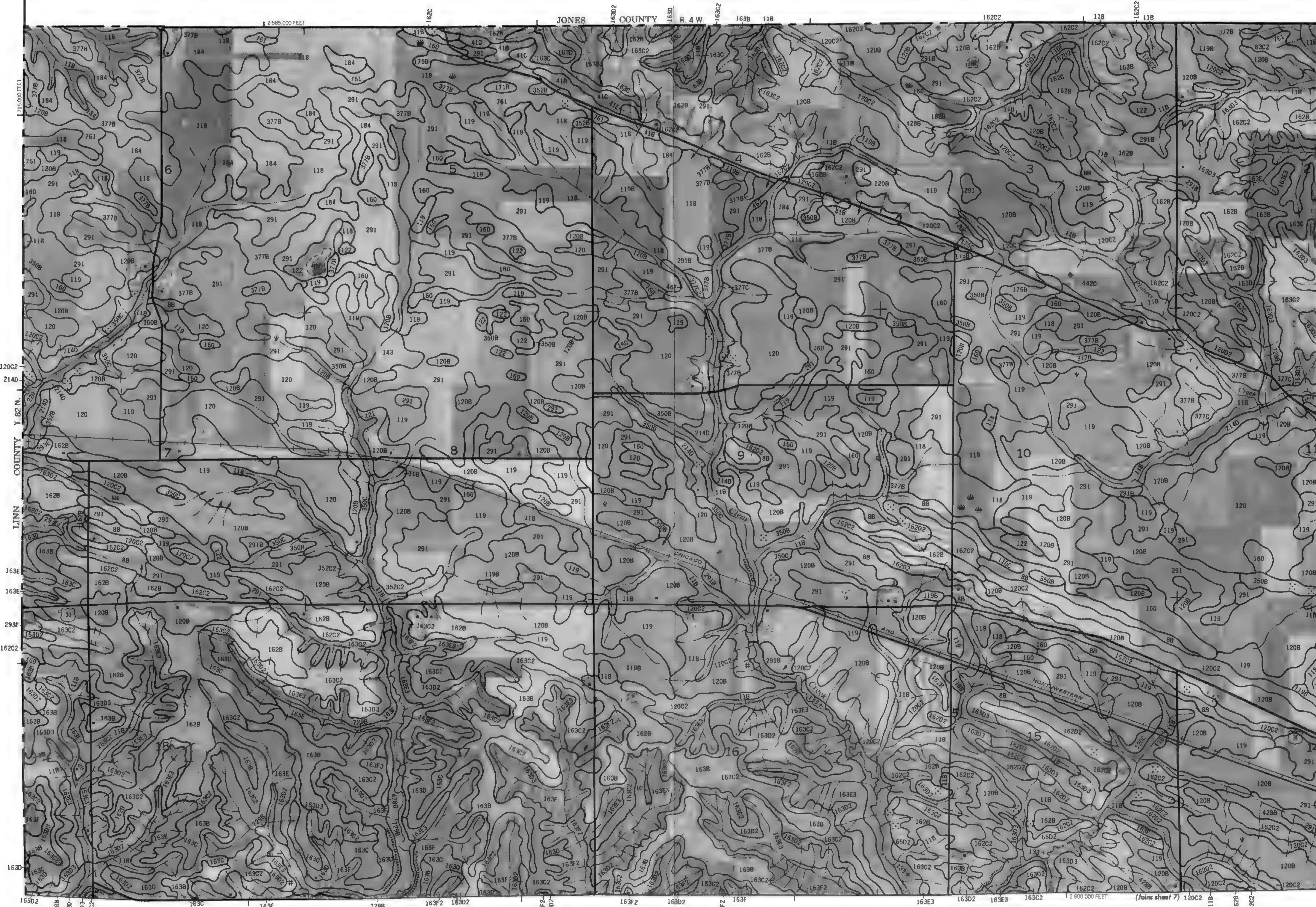
SOIL SAMPLE SITE (normally not shown) — S

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Muck spot
- Calcareous spot
- Fill land spot
- Glacial till spot
- Made land — M.L.
- Quarry — Qu.
- Borrow pit — B.P.
- Sewage lagoon — S.L.

CEDAR COUNTY, IOWA - SHEET NUMBER 1

1
N



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1 Mile
5 000 Feet
Scale 1:15 840

Coordinate grid ticks and land division corners are approximately positioned.

CEDAR COUNTY, IOWA NO. 1

2

N

CEDAR COUNTY, IOWA - SHEET NUMBER 2

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1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

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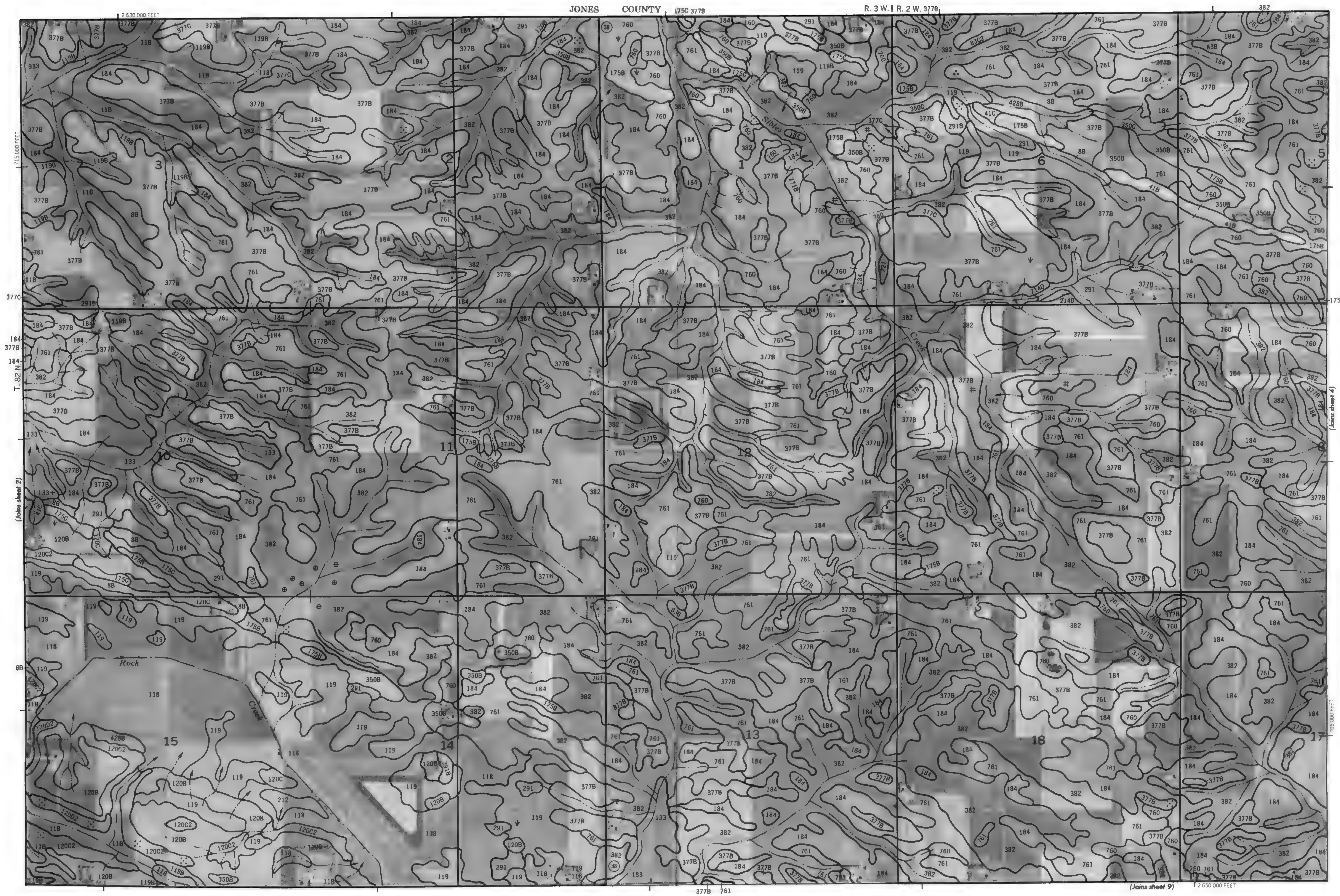
CEDAR COUNTY, IOWA - SHEET NUMBER 3



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CEDAR COUNTY, IOWA NO. 3

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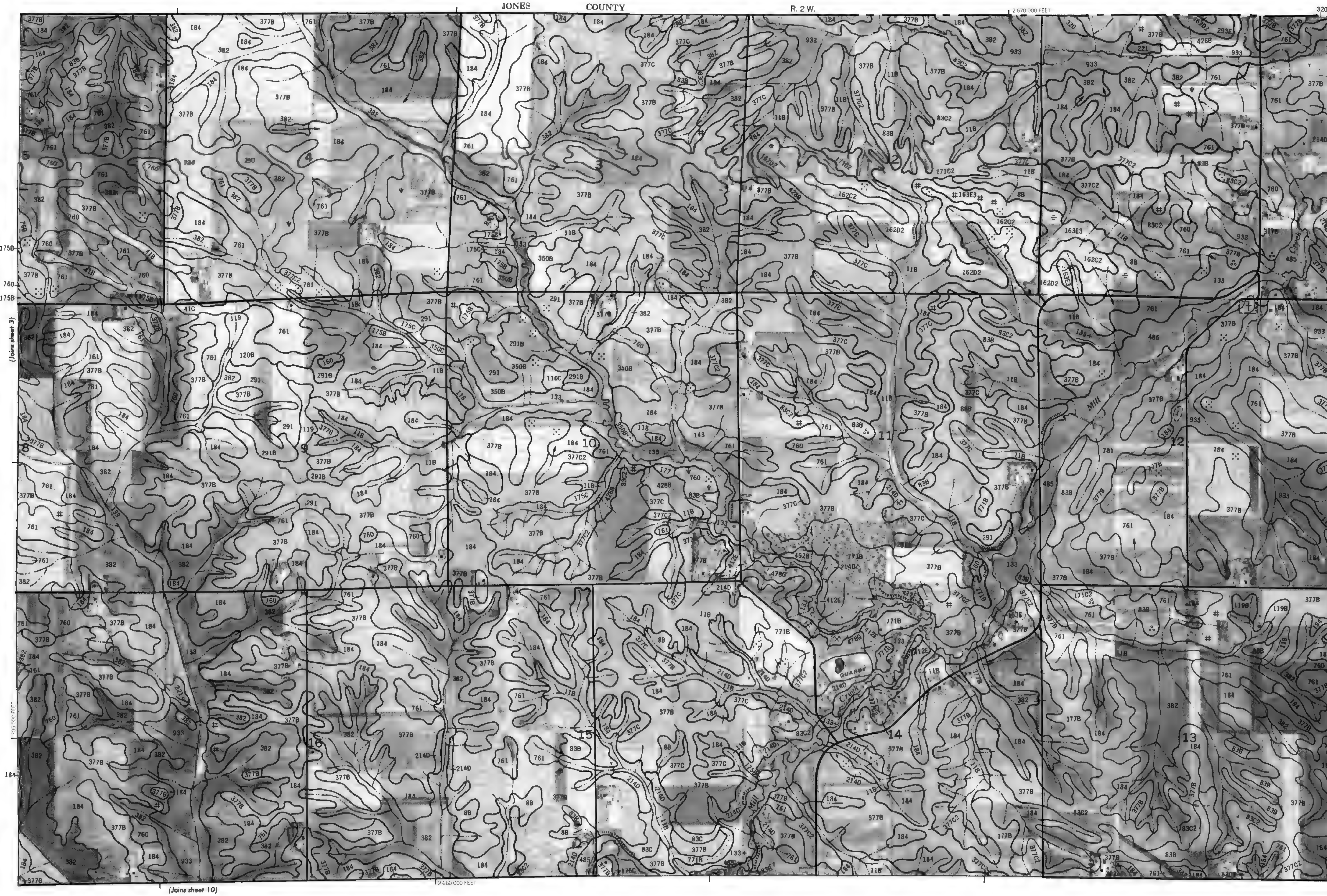
N

CEDAR COUNTY, IOWA - SHEET NUMBER 4



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1 ¾ ½ ¼ 0 1 Mile
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Scale 1:15840

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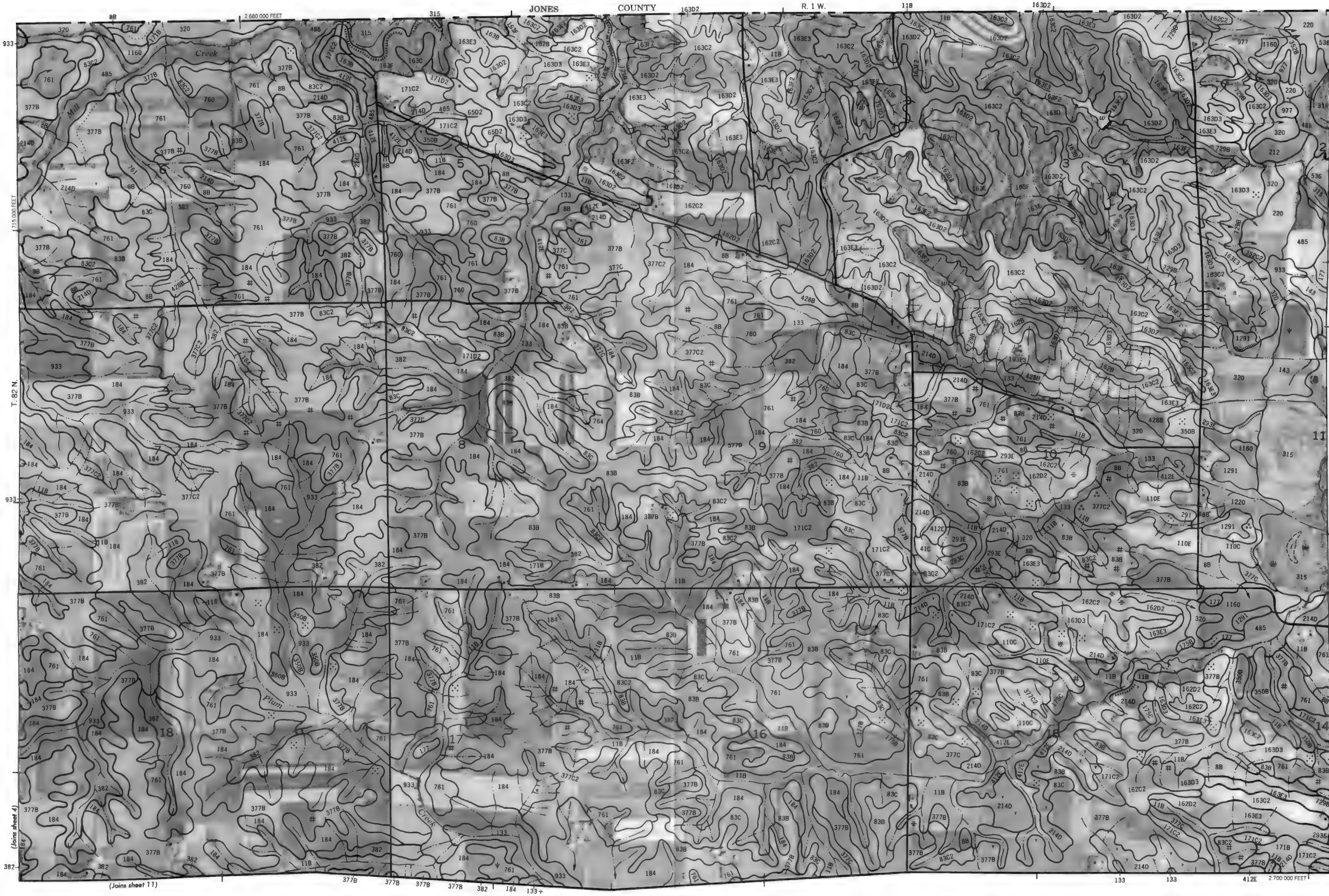
CEDAR COUNTY, IOWA - SHEET NUMBER 5

5
N



CEDAR COUNTY, IOWA NO. 5

1 ¾ ½ ¼ 0 1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

Scale 1:15840

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6
N

CEDAR COUNTY, IOWA - SHEET NUMBER 6

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1 ¾ ½ ¼ 0 1 Mile
5000 4000 3000 2000 1000 0 5000 Feet
Scale 1:15840

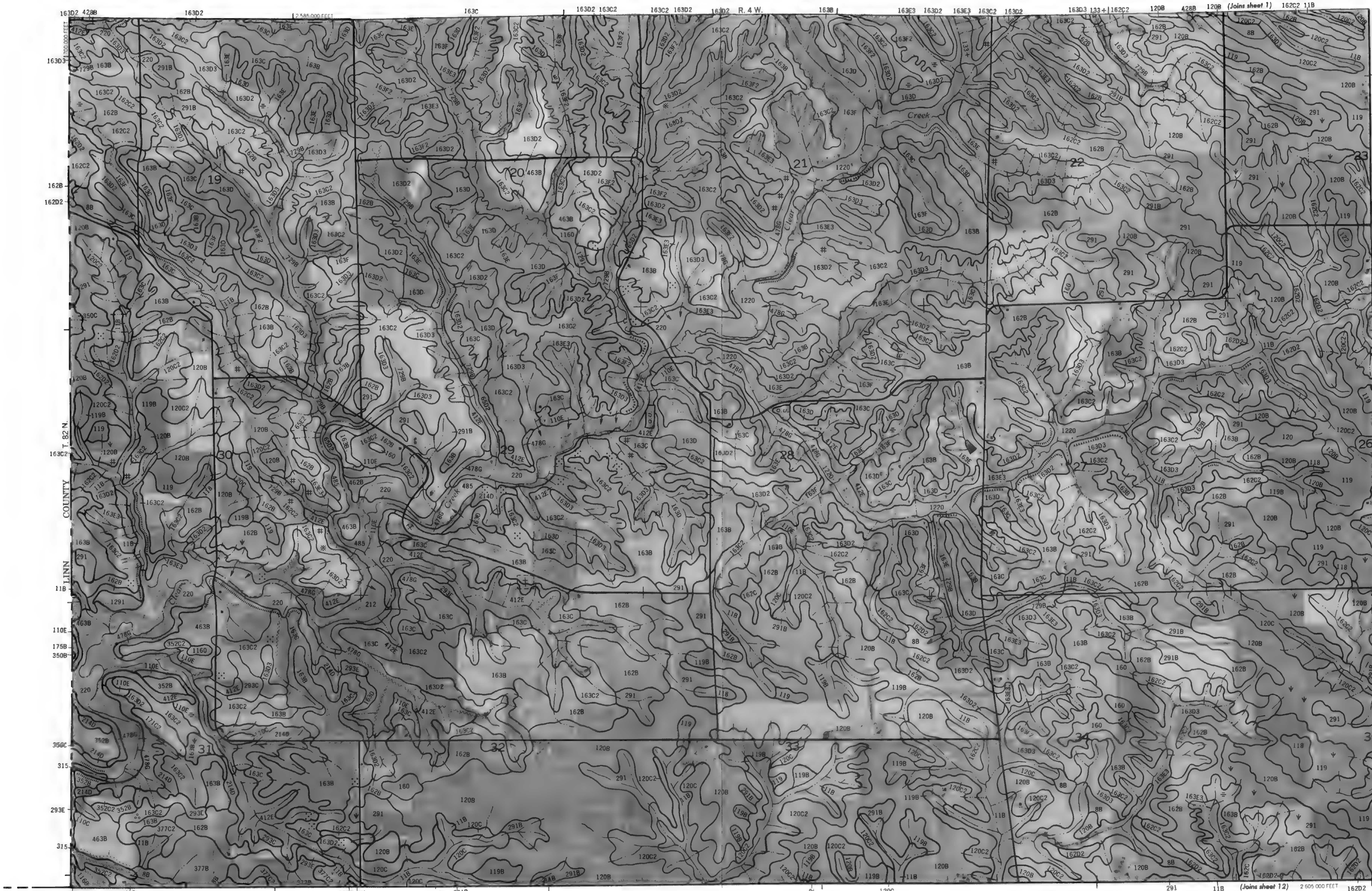
Coordinate grid ticks and land division corners are approximately positioned.

CEDAR COUNTY, IOWA NO. 6

CEDAR COUNTY, IOWA - SHEET NUMBER 7

7

N



1 — ¾ — ½ — ¼ — 0 — 1 Mile

5 000 — 4 000 — 3 000 — 2 000 — 1 000 — 0 — 5 000 Feet

Scale 1:15840

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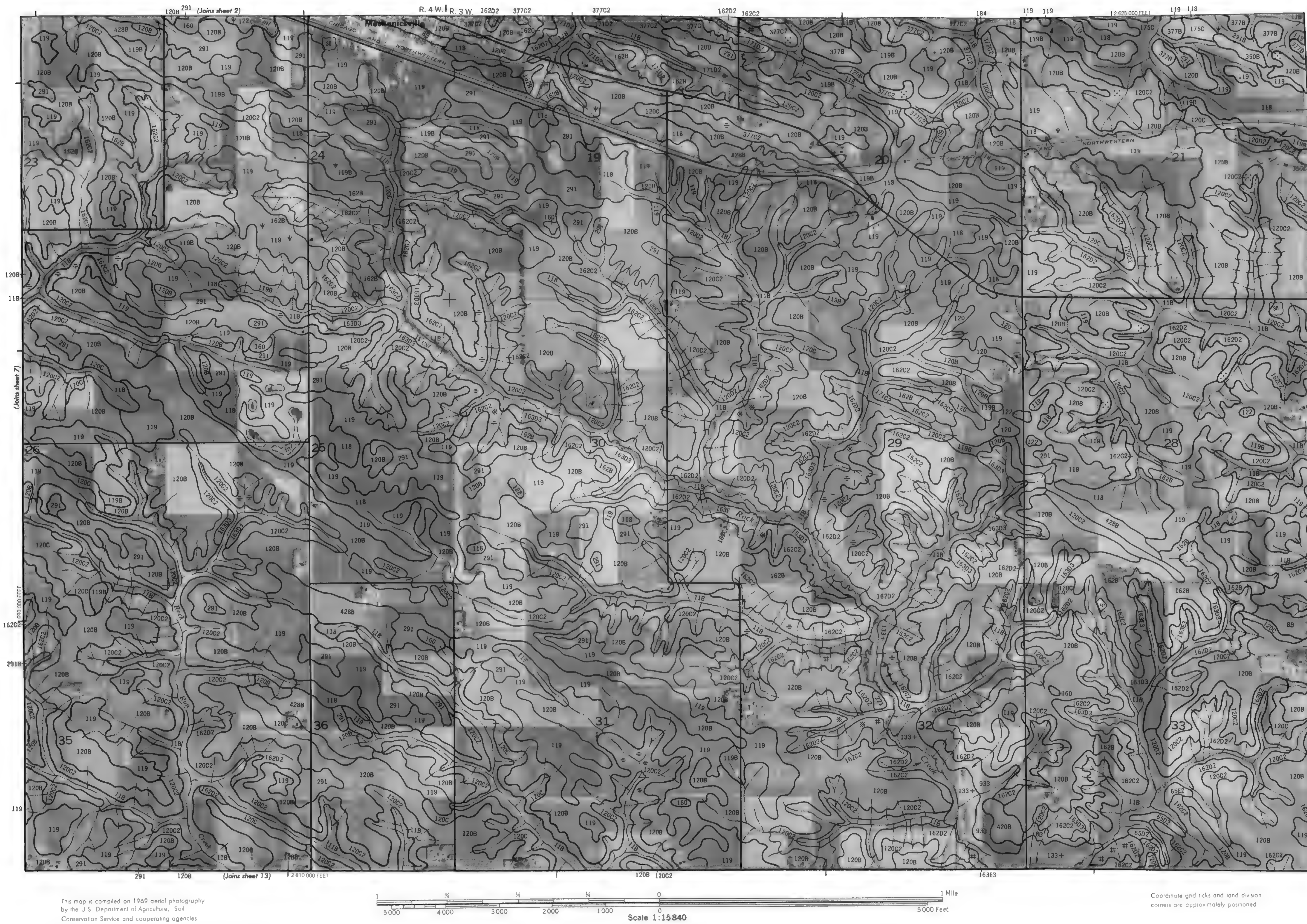
CEDAR COUNTY, IOWA NO. 7

CEDAR COUNTY, IOWA - SHEET NUMBER 8



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CEDAR COUNTY, IOWA - SHEET NUMBER 9

9
N

CEDAR COUNTY, IOWA NO. 9

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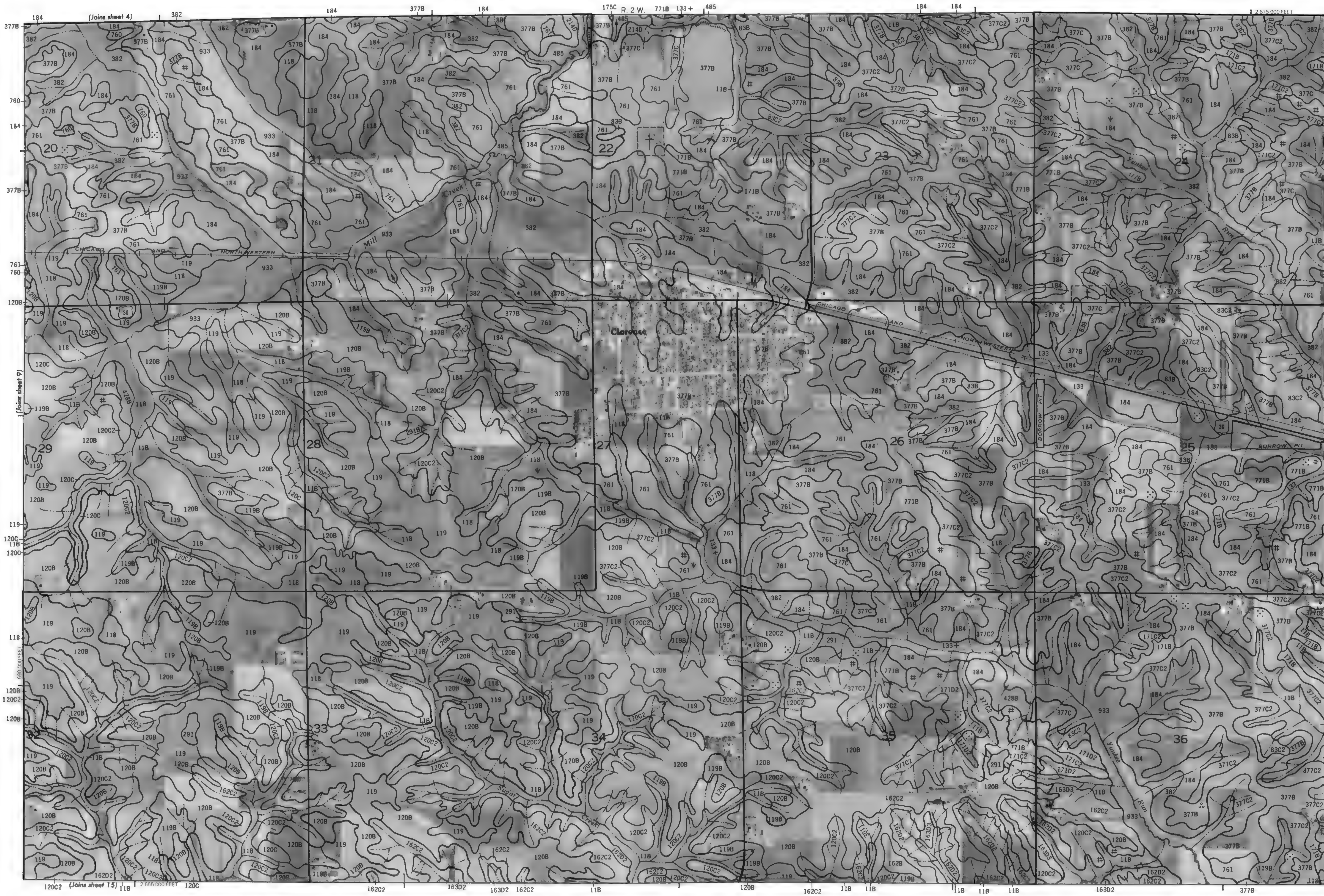
1 ¾ ½ ¼ 0 1 Mile
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet
Scale 1:15 840

Coordinate grid ticks and land division corners are approximately positioned.

10

N

CEDAR COUNTY, IOWA - SHEET NUMBER 10



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1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:15840

Coordinate grid ticks and land division corners are approximately positioned.

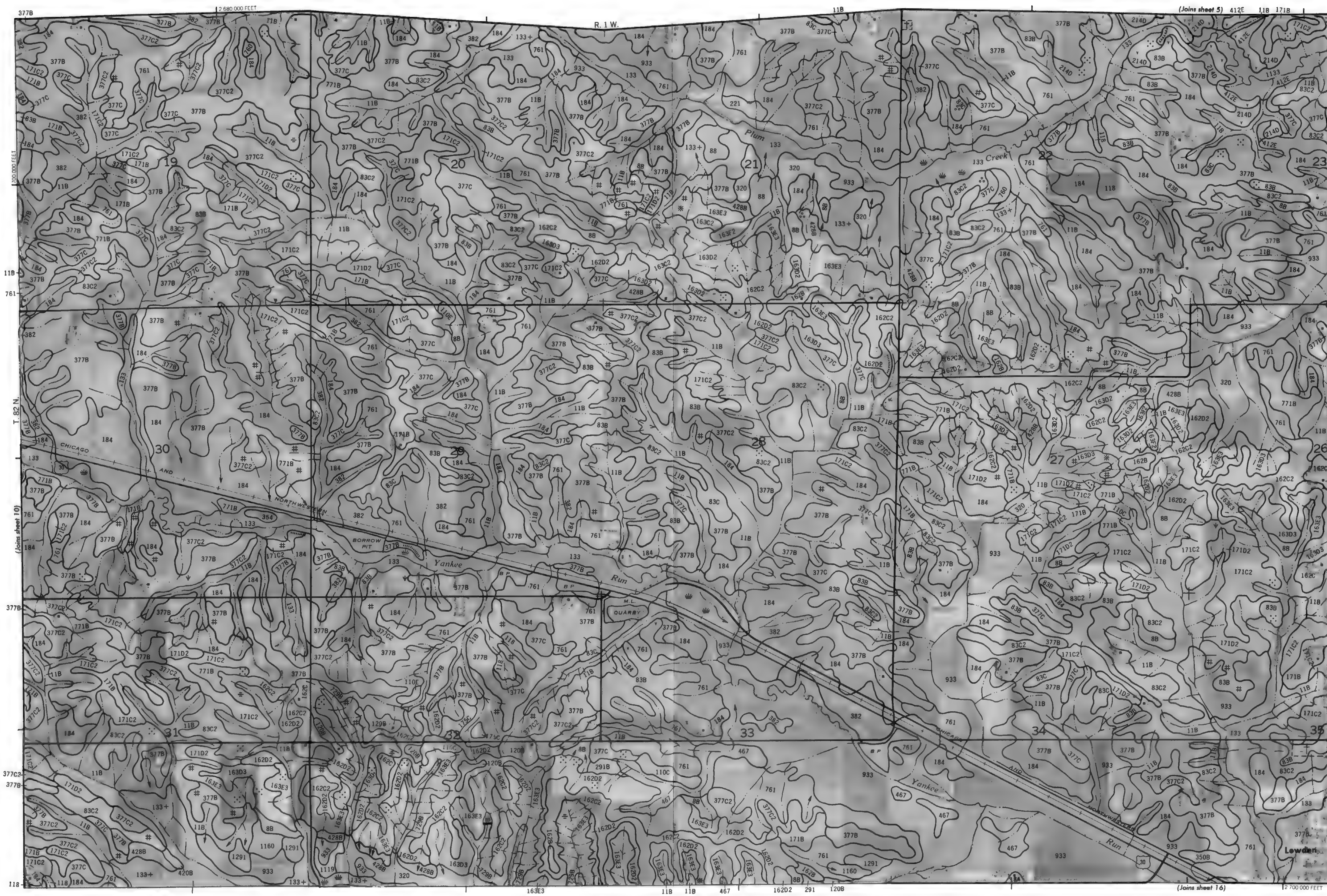
CEDAR COUNTY, IOWA NO. 10

CEDAR COUNTY, IOWA - SHEET NUMBER 11

11

N

CEDAR COUNTY, IOWA NO. 11



1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

Scale 1:15 840

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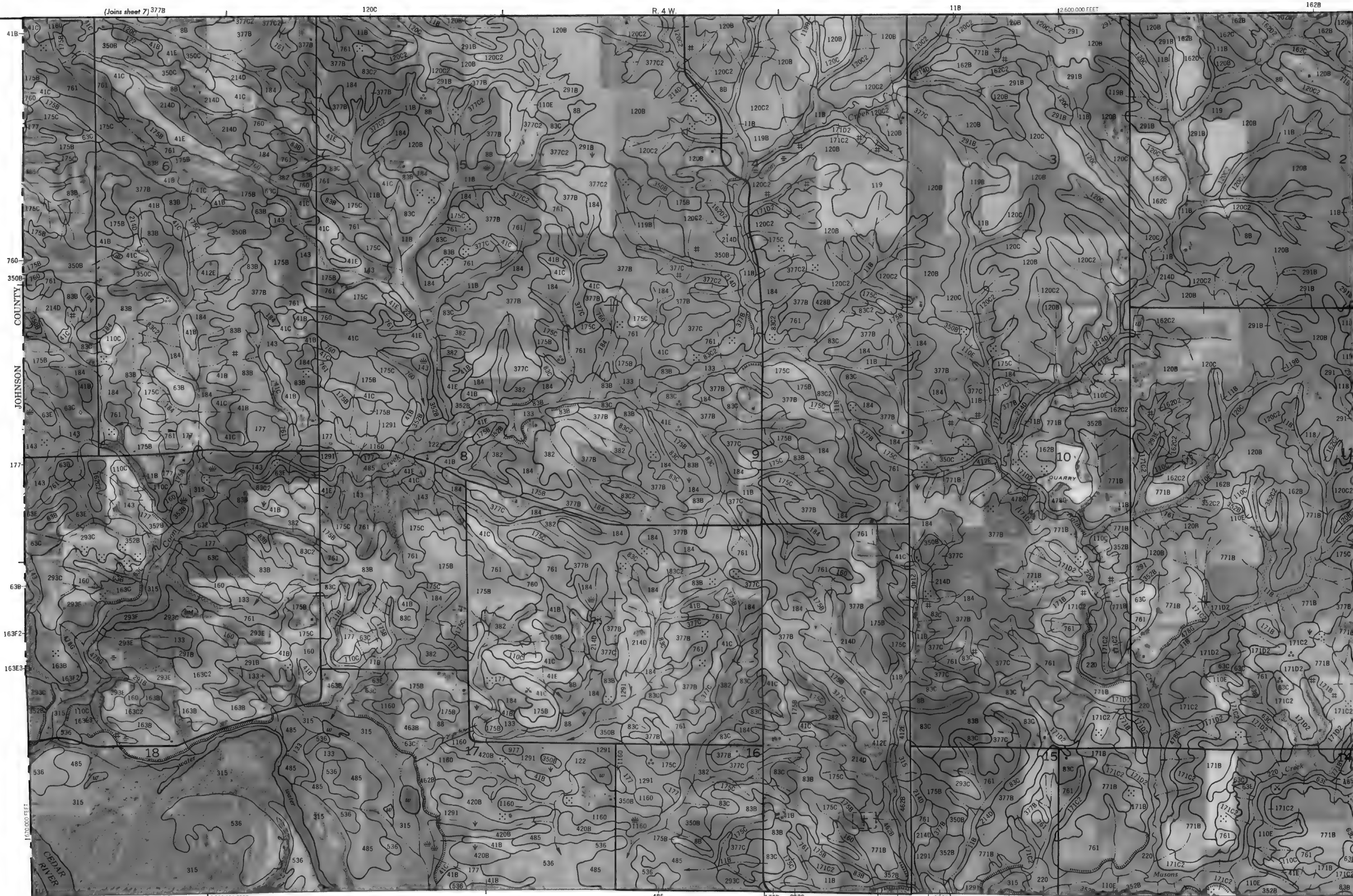
Coordinate grid ticks and land division corners are approximately positioned.

12

N

CEDAR COUNTY, IOWA - SHEET NUMBER 12



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1 ¾ ½ ¼ 0 1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

Scale 1:15 840

Coordinate grid ticks and land division corners are approximately positioned.

CEDAR COUNTY, IOWA NO. 12

CEDAR COUNTY, IOWA - SHEET NUMBER 13

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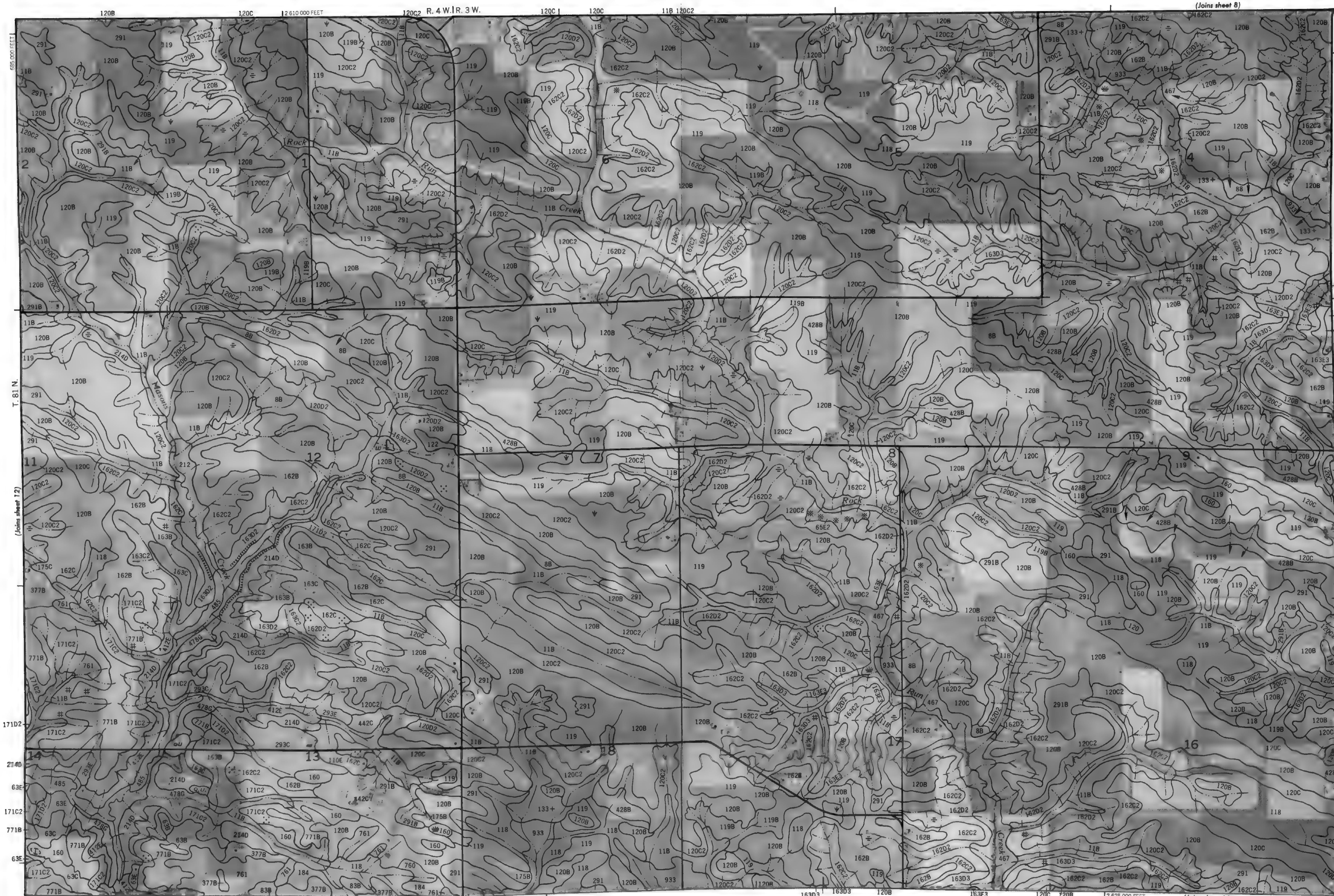


1 ¾ ½ ¼ 0 1 Mile
5000 4000 3000 2000 1000 0 5000 Feet
Scale 1:15840

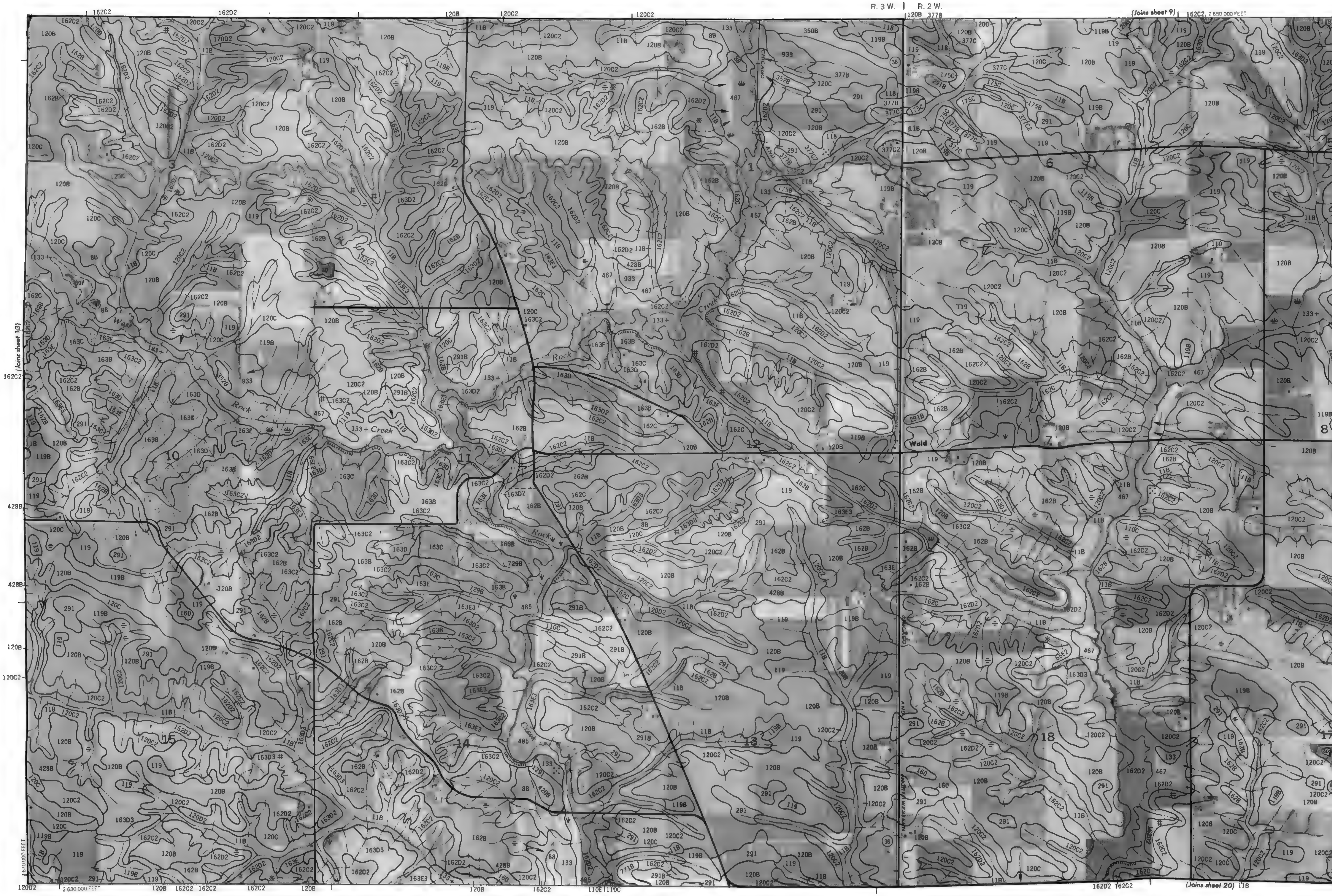
This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

Coordinate grid ticks and land division corners are approximately positioned

14

N

CEDAR COUNTY, IOWA - SHEET NUMBER 14



This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 Mile

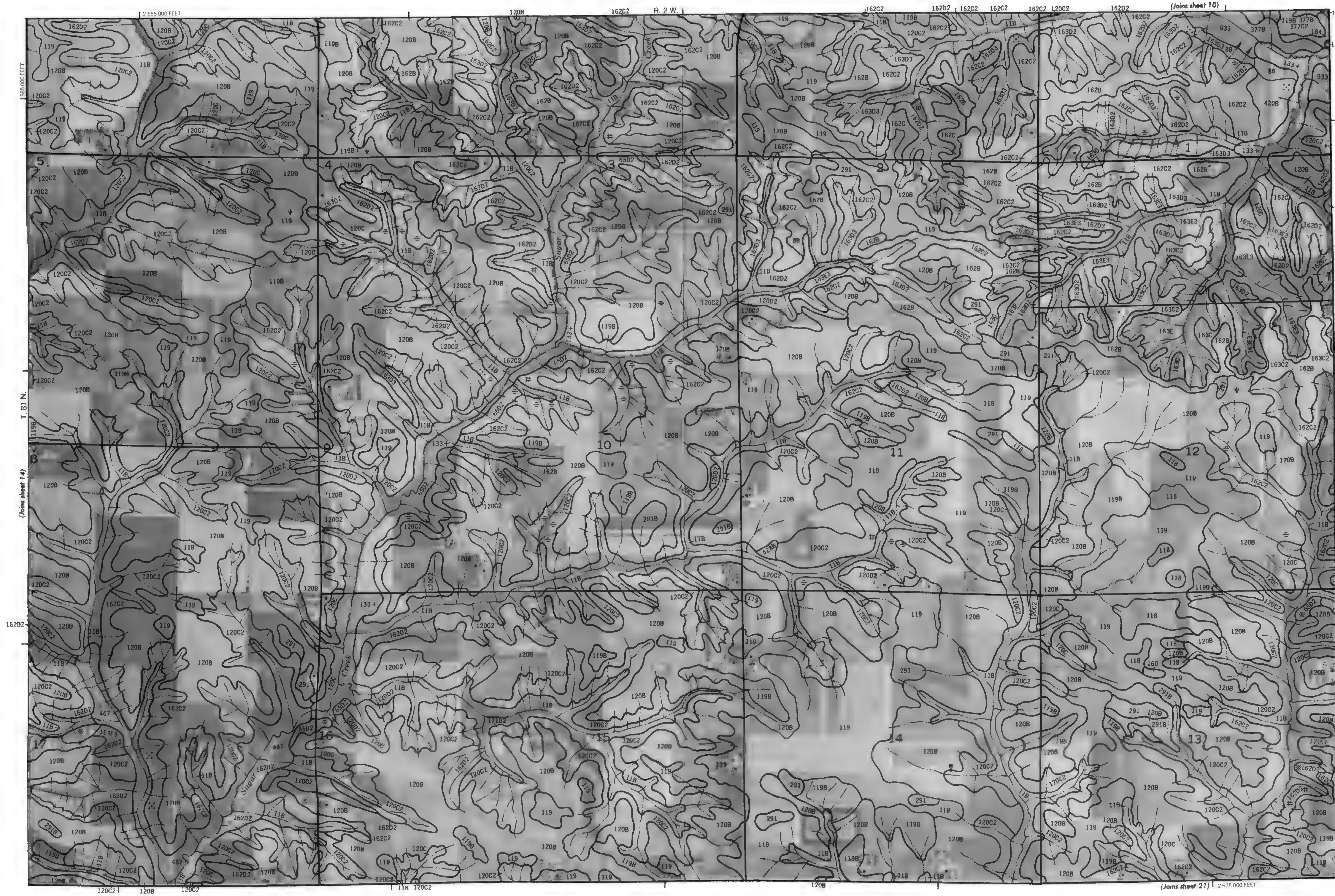
5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:15840

Coordinate grid ticks and land division corners are approximately positioned.

CEDAR COUNTY, IOWA - SHEET NUMBER 15

N



This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

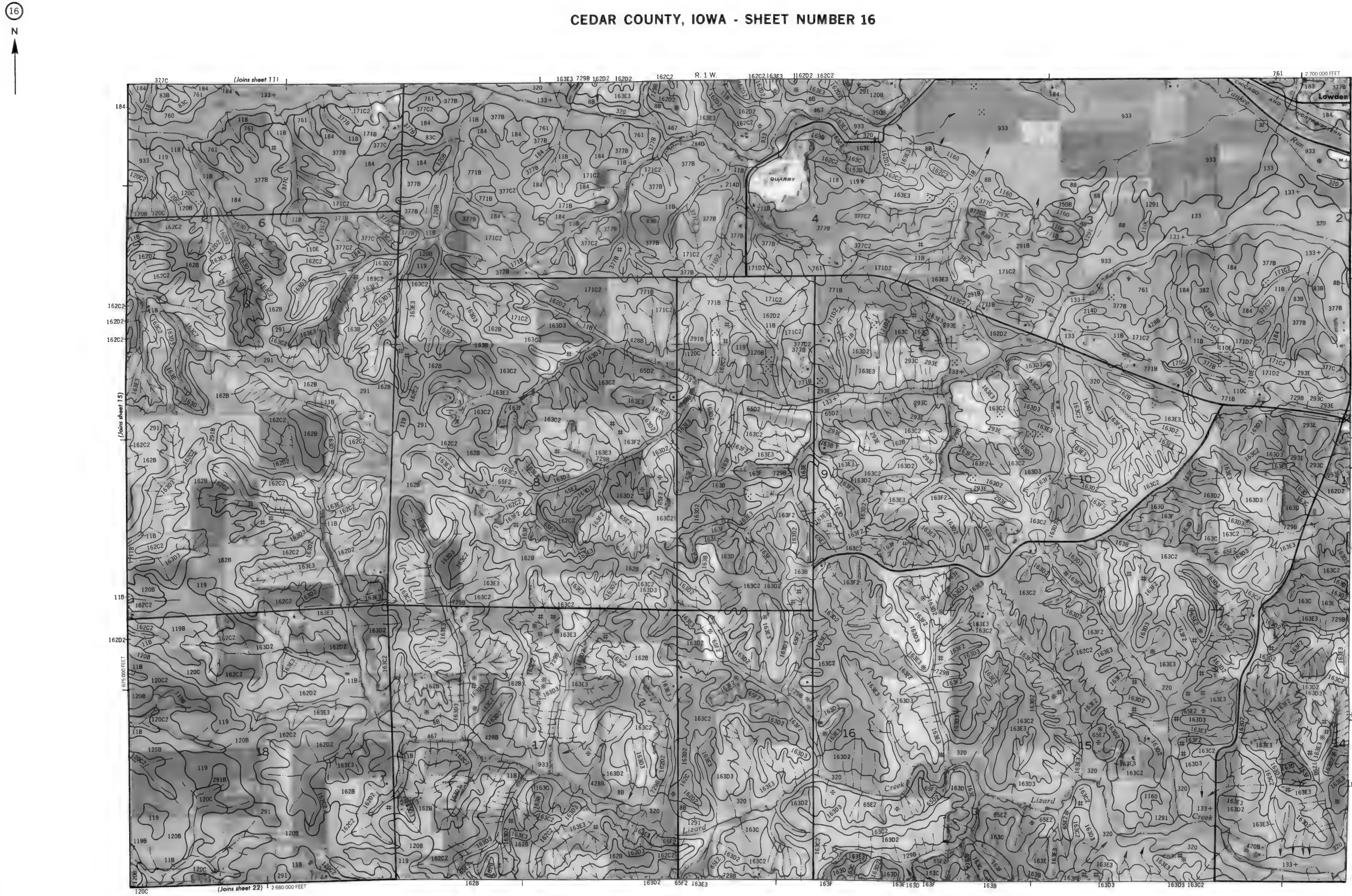
1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:15840

Coordinate grid ticks and land division corners are approximately positioned.

CEDAR COUNTY, IOWA - SHEET NUMBER 16



This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

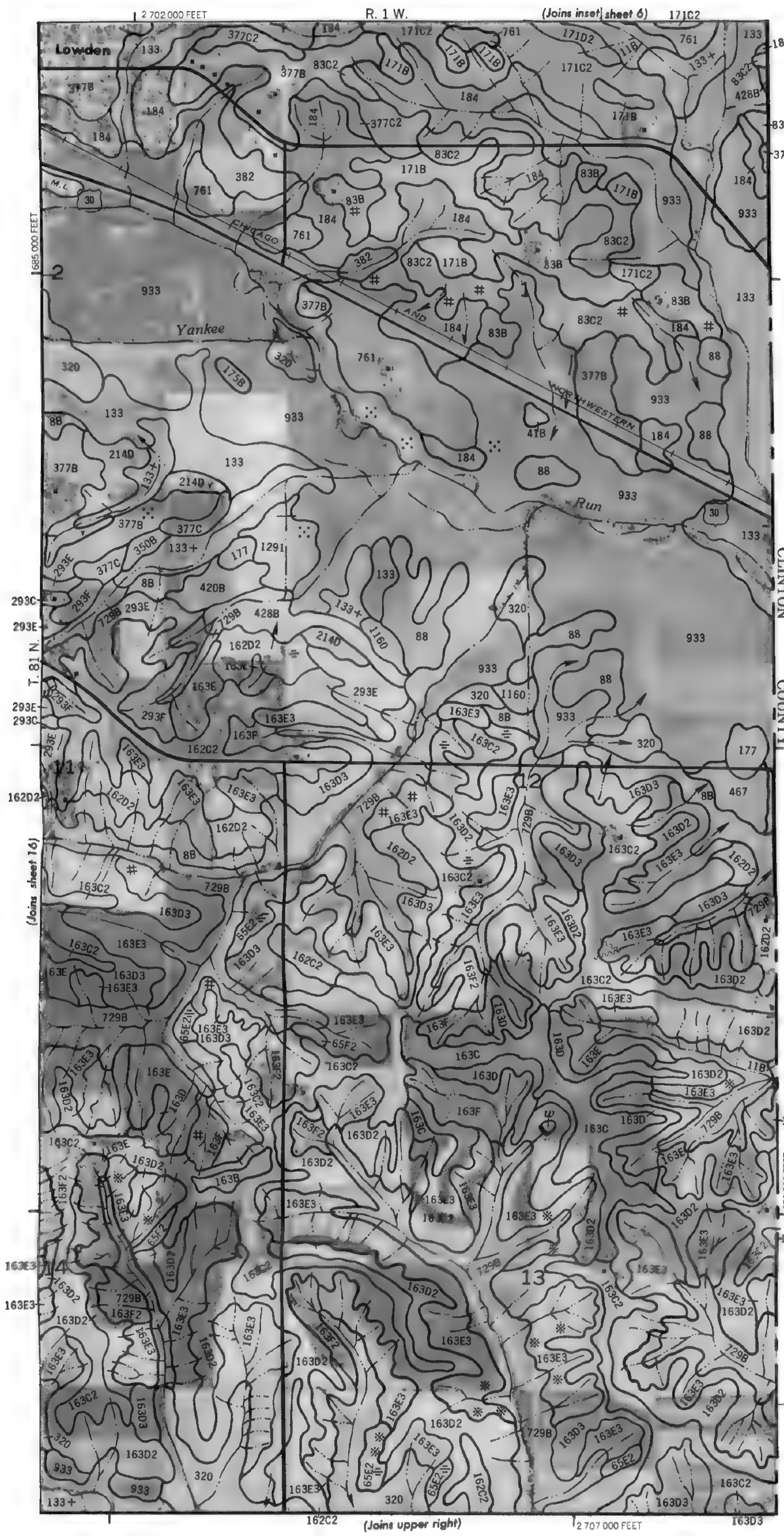
1 Mile — 5000 Feet

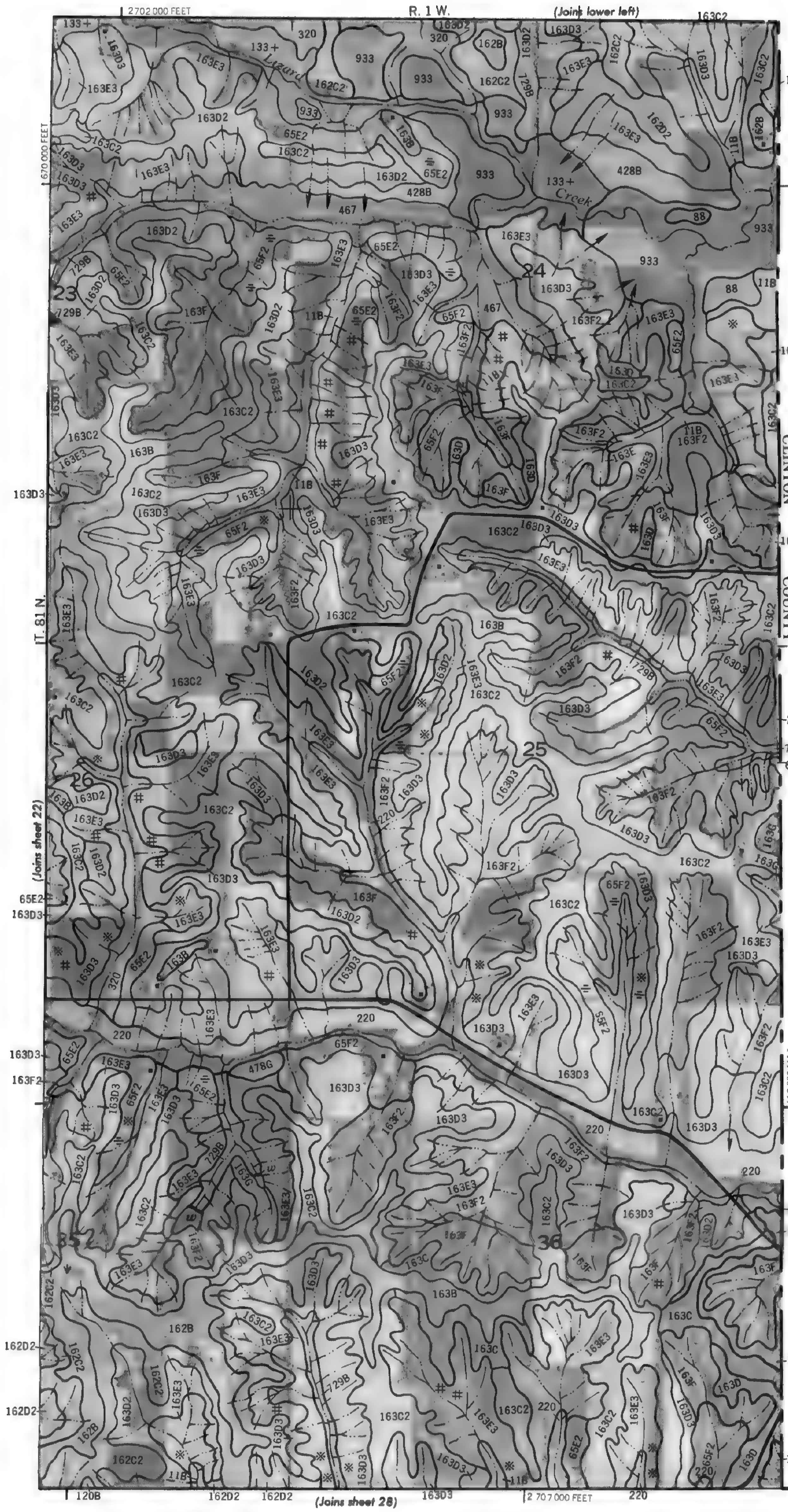
Scale 1:15840

Coordinate grid ticks and land division corners are approximately positioned.

CEDAR COUNTY, IOWA - SHEET NUMBER 17

N





This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

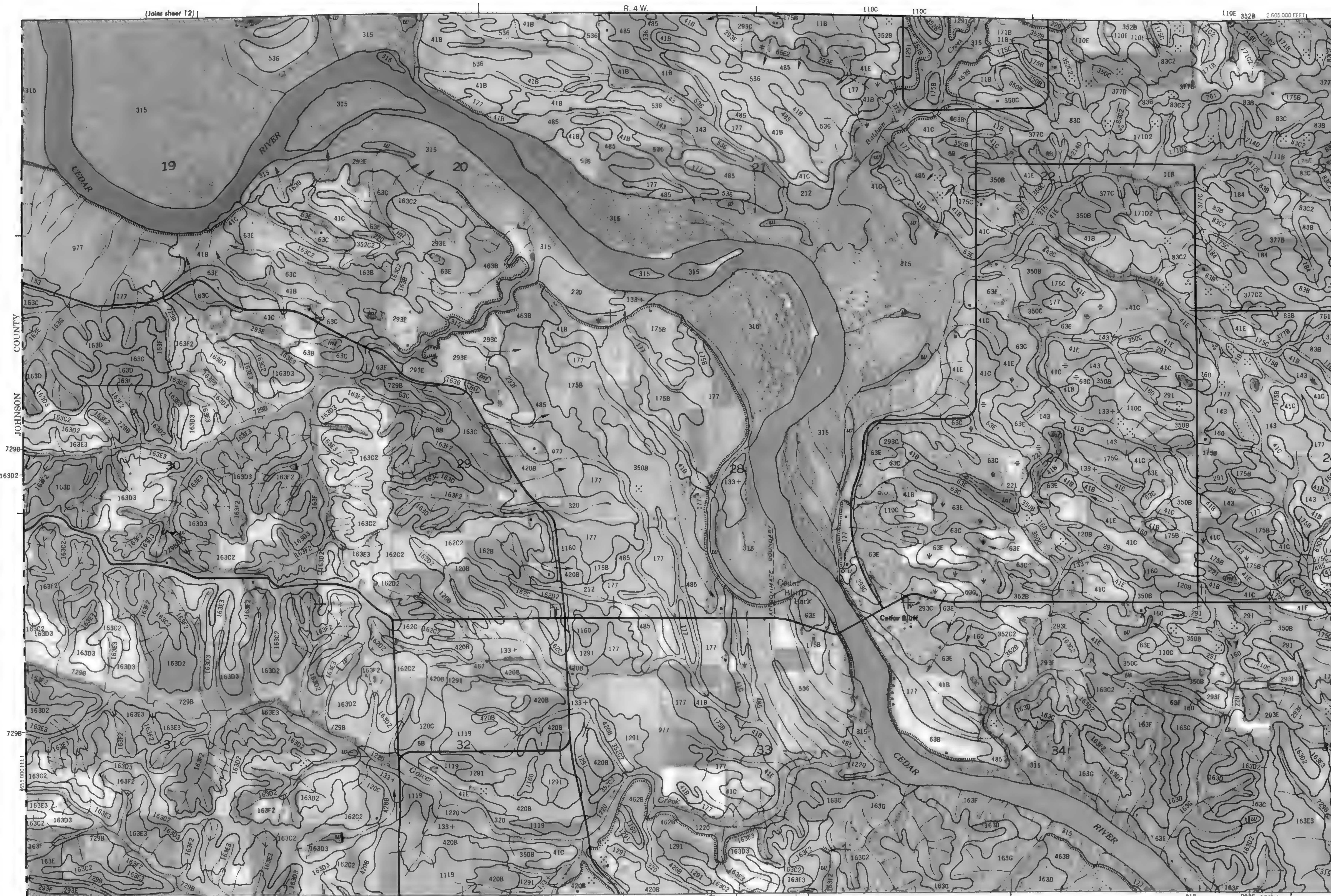
Scale 1:15840

Coordinate grid ticks and land division corners are approximately positioned.

(18)

N

CEDAR COUNTY, IOWA - SHEET NUMBER 18



1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:15840

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

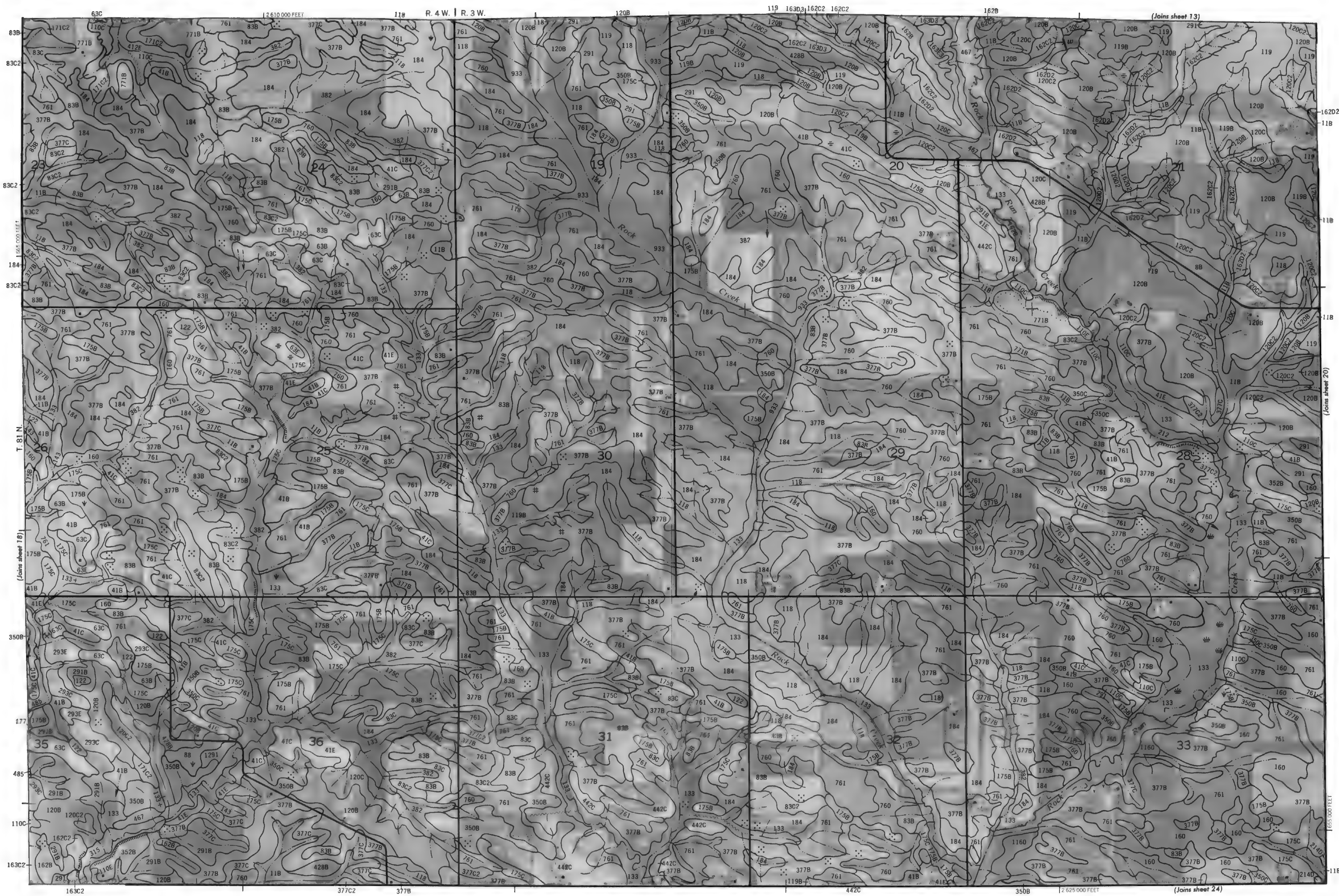
Coordinate grid ticks and land division corners are approximately positioned.

19

N

CEDAR COUNTY, IOWA - SHEET NUMBER 19

CEDAR COUNTY, IOWA NO. 19



This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:15840

Coordinate grid ticks and land division corners are approximately positioned.

20

N

CEDAR COUNTY, IOWA - SHEET NUMBER 20

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

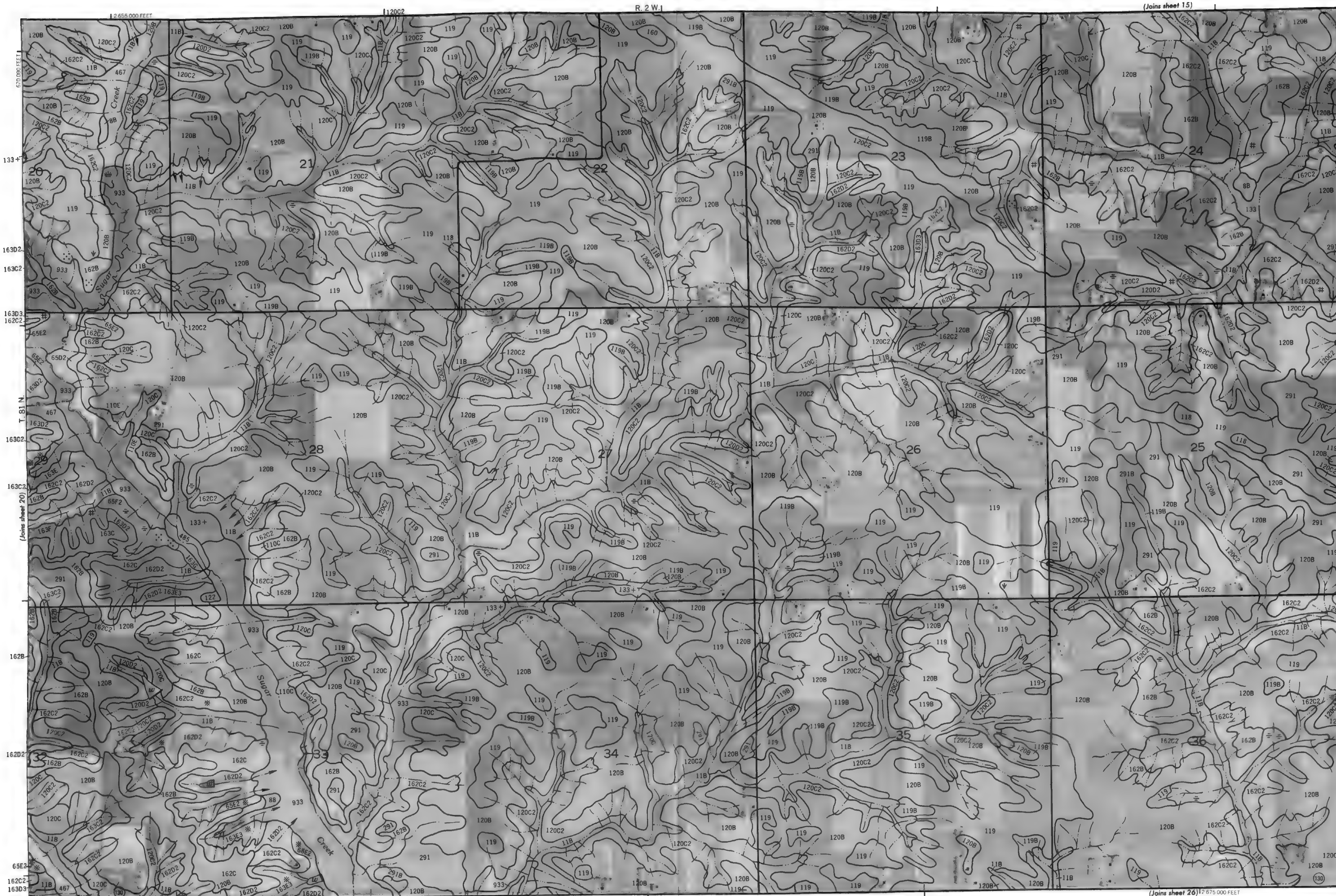
Scale 1:15 840

Coordinate grid ticks and land division corners are approximately positioned.

CEDAR COUNTY, IOWA NO. 20

CEDAR COUNTY, IOWA - SHEET NUMBER 21

N



This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

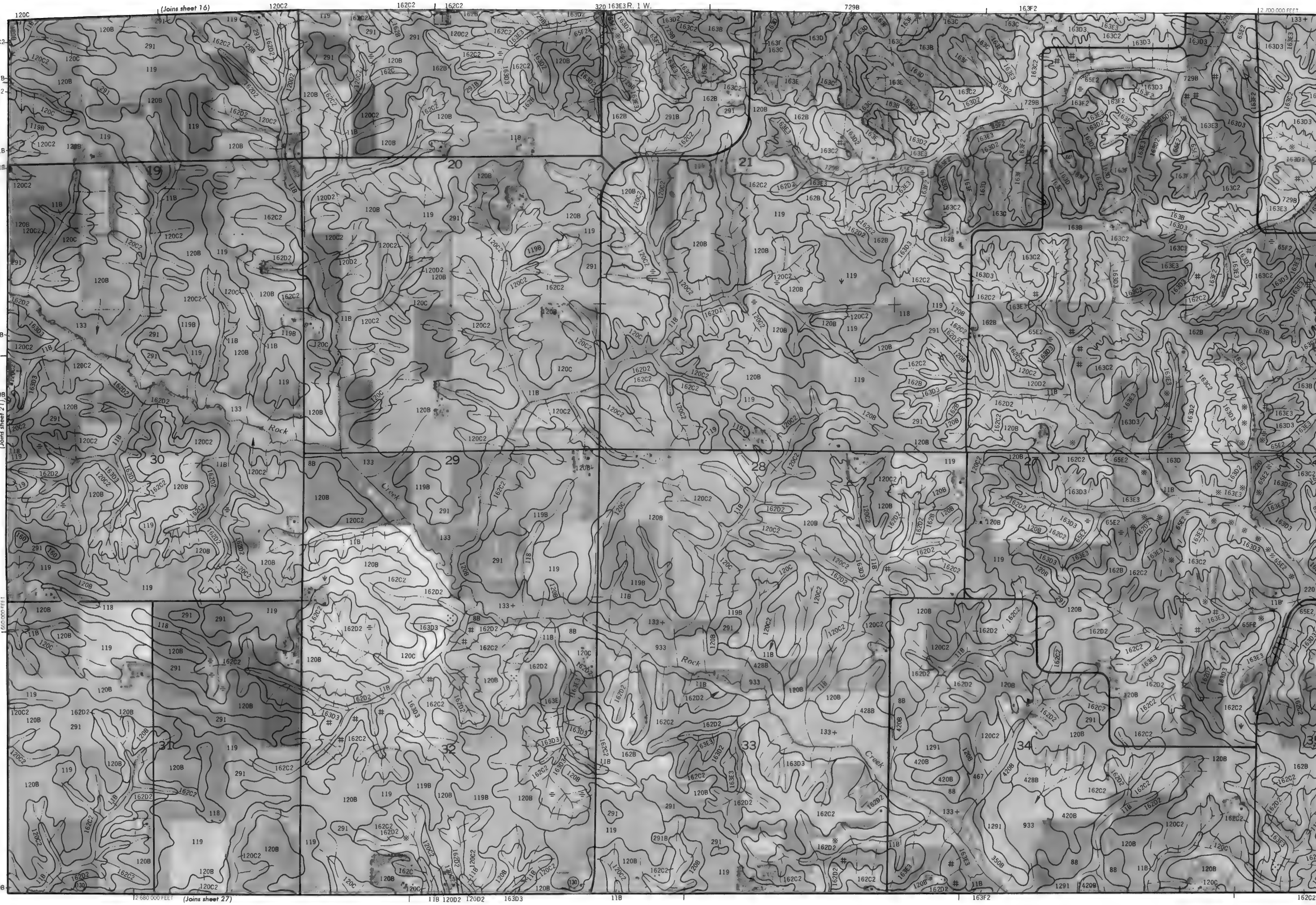
Scale 1:15 840

Coordinate grid ticks and land division corners are approximately positioned.

22

N

CEDAR COUNTY, IOWA - SHEET NUMBER 22



This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

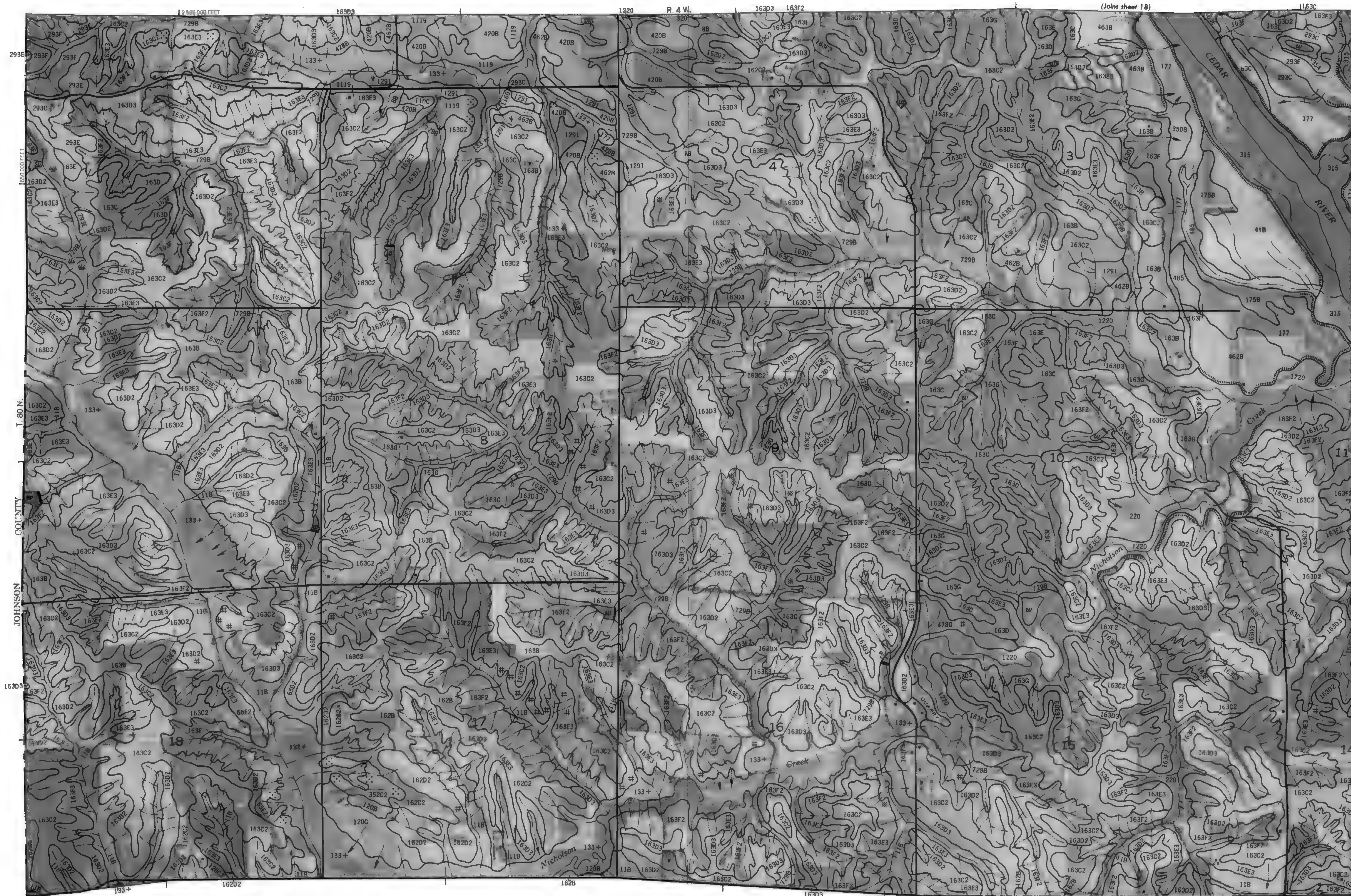
Scale 1:15840

Coordinate grid ticks and land division corners are approximately positioned

CEDAR COUNTY, IOWA NO. 22

CEDAR COUNTY, IOWA - SHEET NUMBER 23

N



1 ¾ ½ ¼ 0 1 Mile

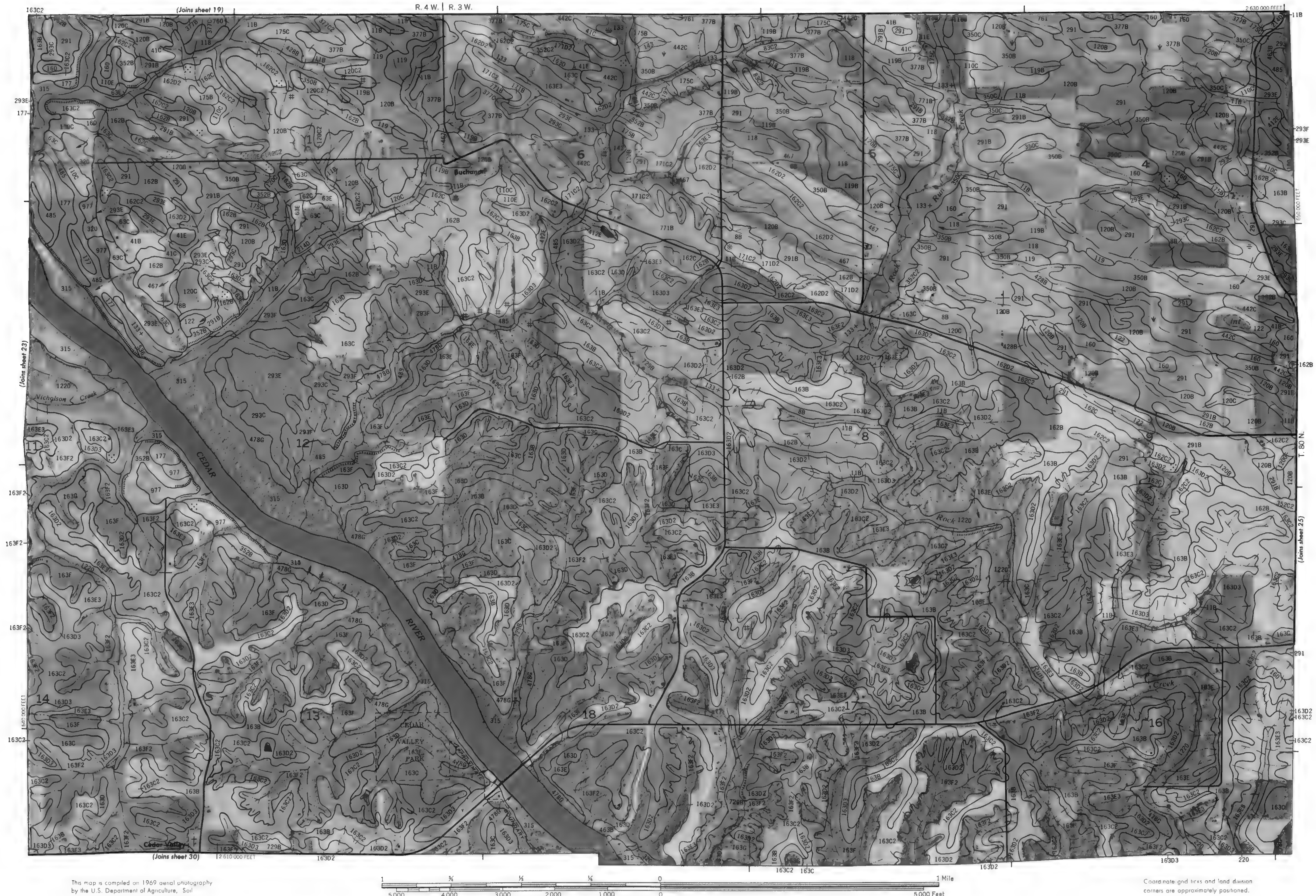
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

Scale 1:15840

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

Coordinate grid ticks and land division corners are approximately positioned

CEDAR COUNTY, IOWA - SHEET NUMBER 24



This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

Coordinate grid ticks and land division corners are approximately positioned.

N

CEDAR COUNTY, IOWA - SHEET NUMBER 25

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

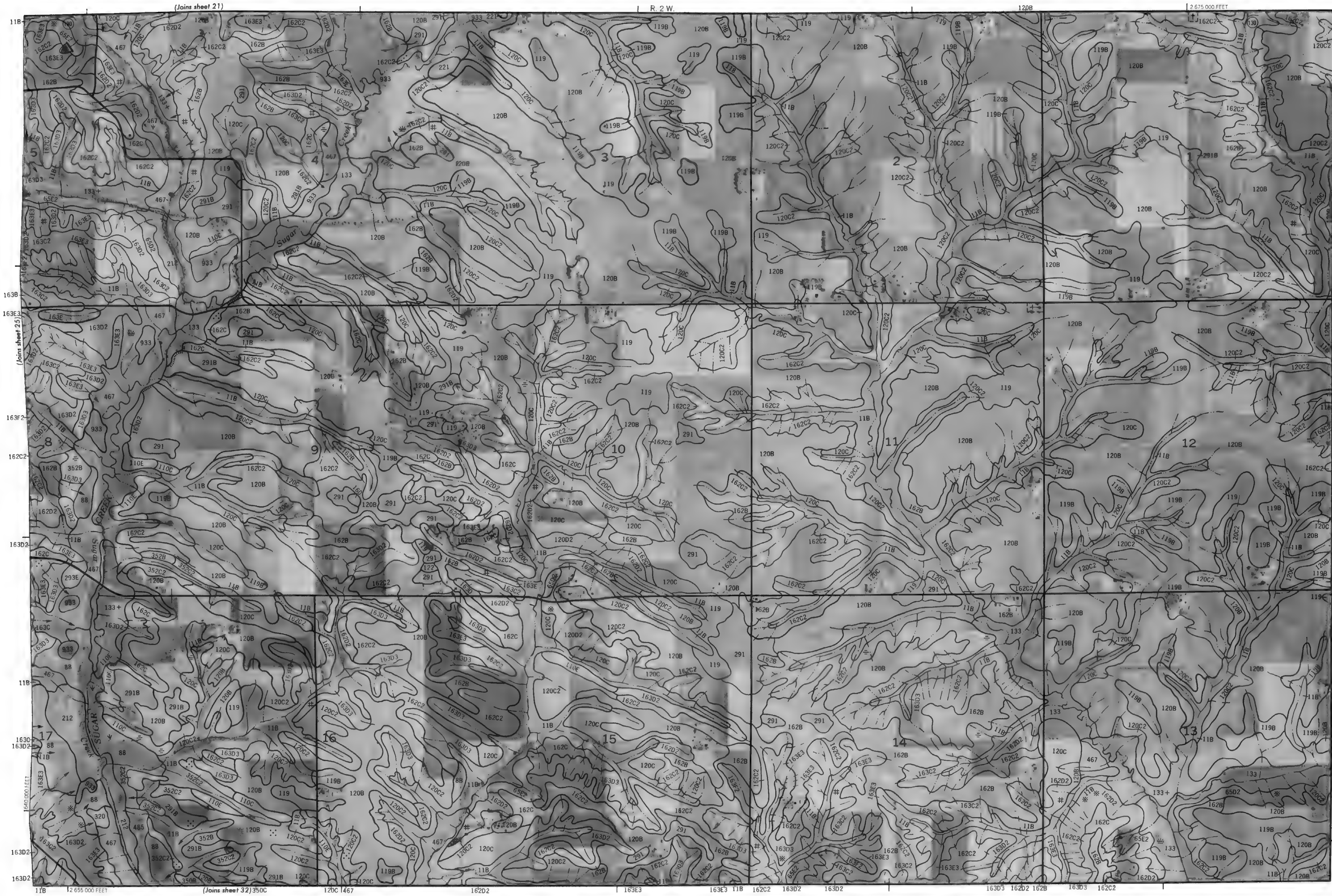
Scale 1:15 840

Coordinate grid ticks and land division corners are approximately positioned.

26

N

CEDAR COUNTY, IOWA - SHEET NUMBER 26



This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

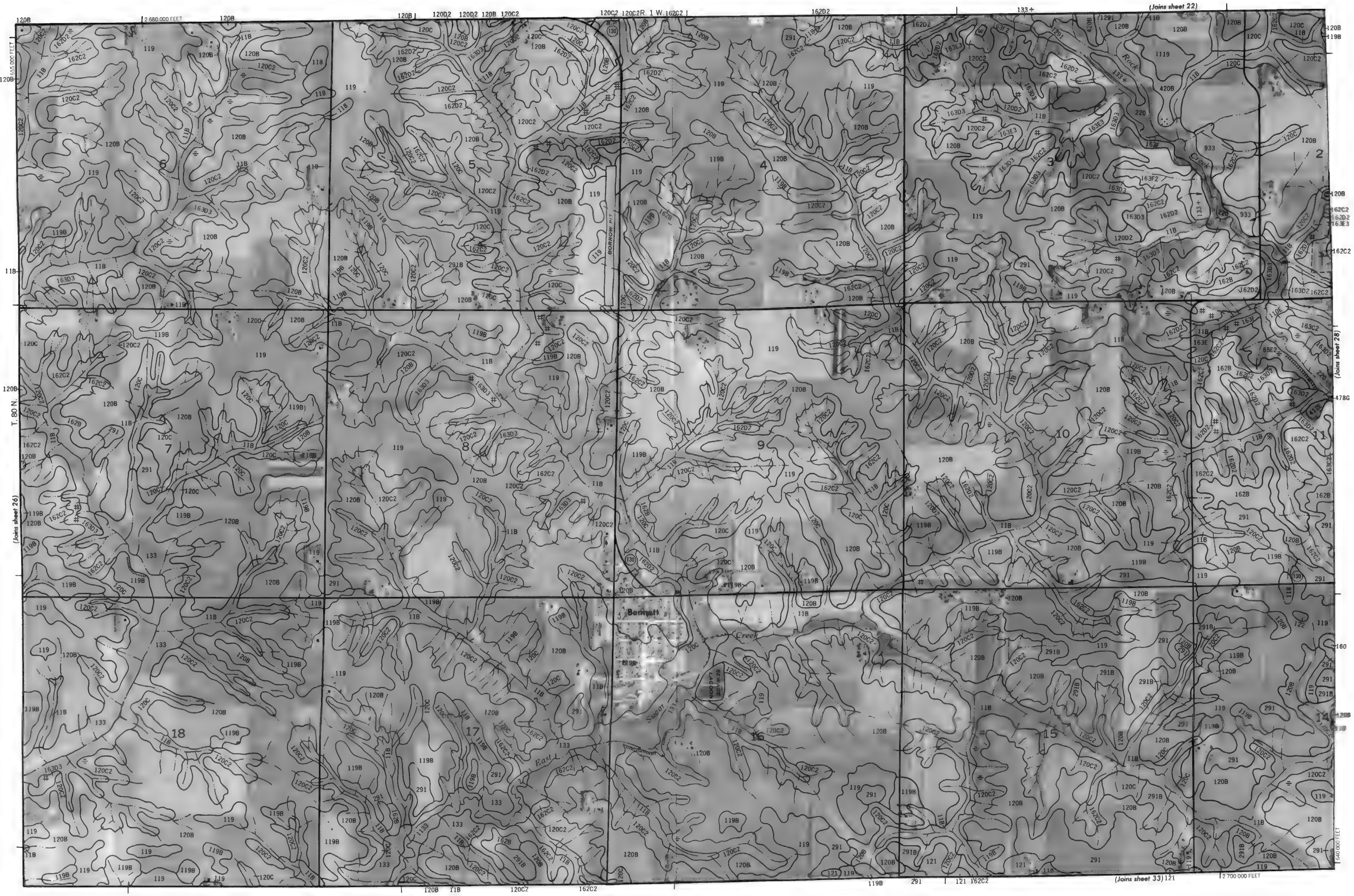
Scale 1:15840

Coordinate grid ticks and land division corners are approximately positioned.

CEDAR COUNTY, IOWA NO. 26

CEDAR COUNTY, IOWA - SHEET NUMBER 27

N



1 3/4 1/2 1/4 0 1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

Scale 1:15 840

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

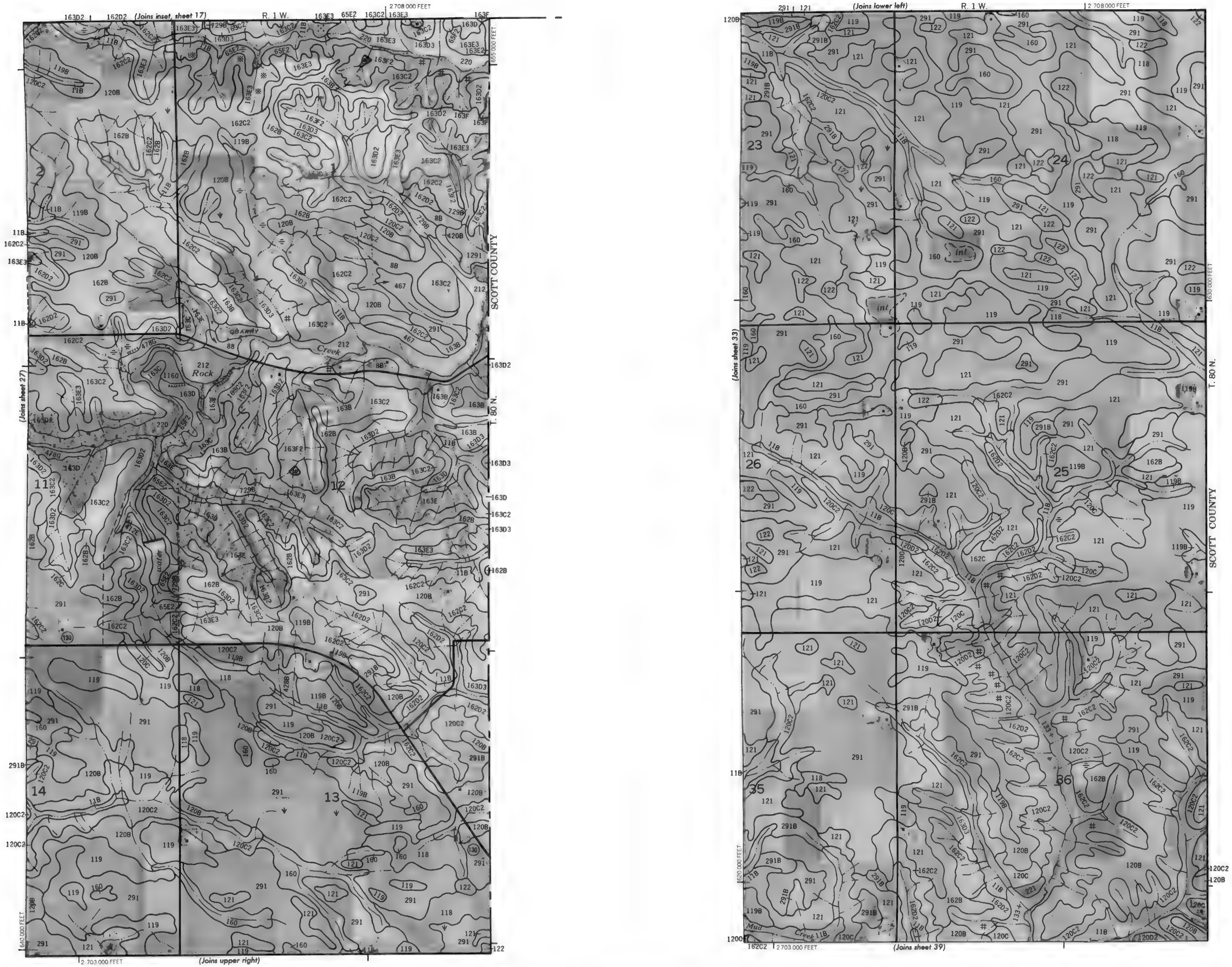
Coordinate grid ticks and land division corners are approximately positioned

CEDAR COUNTY, IOWA NO. 27

28

N

CEDAR COUNTY, IOWA - SHEET NUMBER 28



This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 Mile

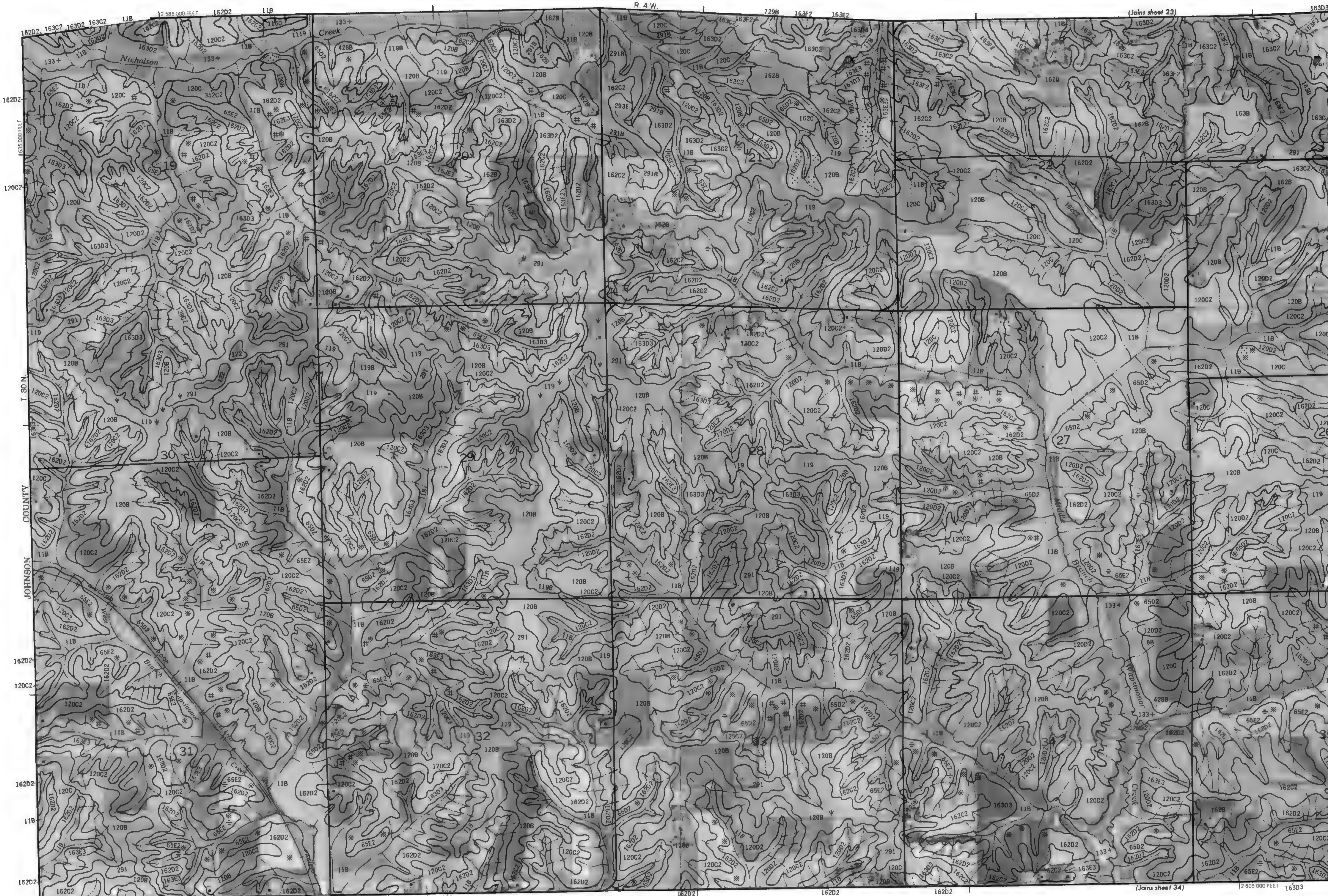
5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:15840

Coordinate grid ticks and land division corners are approximately positioned.

CEDAR COUNTY, IOWA NO. 28

CEDAR COUNTY, IOWA - SHEET NUMBER 29



This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

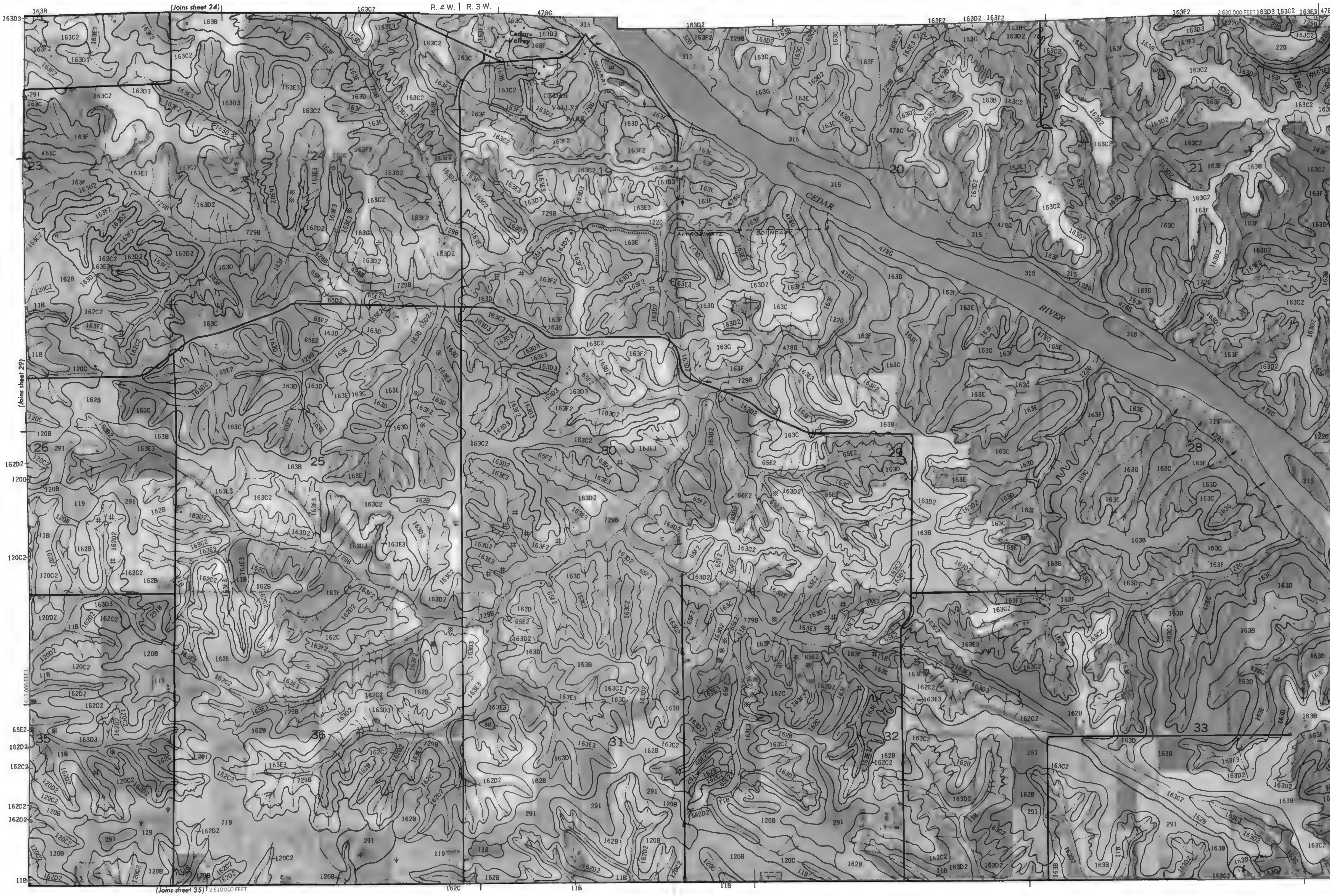
Scale 1:15840

Coordinate grid ticks and land division corners are approximately positioned.

30

N

CEDAR COUNTY, IOWA - SHEET NUMBER 30



1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:15840

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

Coordinate grid ticks and land division corners are approximately positioned.

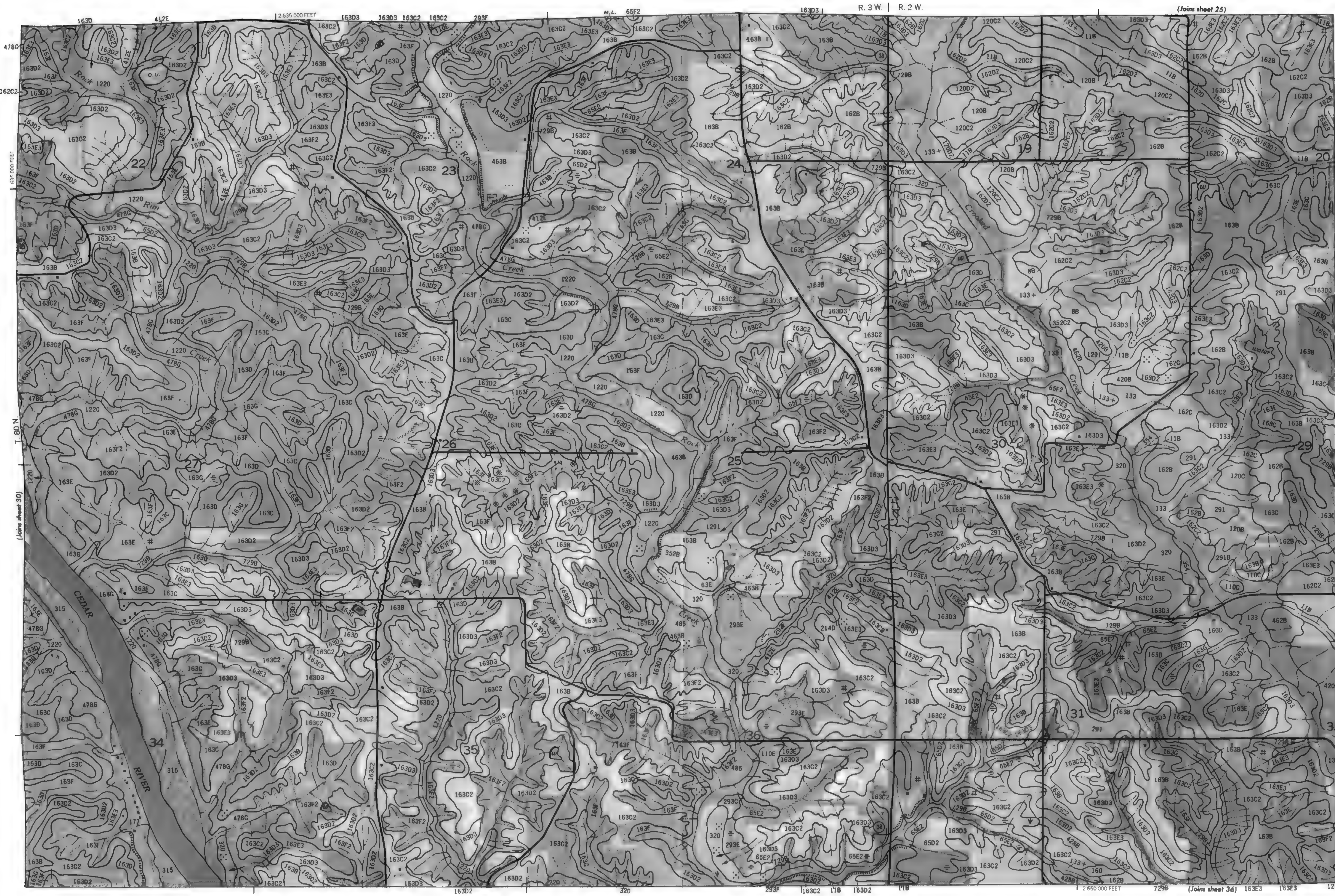
CEDAR COUNTY, IOWA NO. 30

CEDAR COUNTY, IOWA - SHEET NUMBER 31

31

N

CEDAR COUNTY, IOWA NO. 31



This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 Mile

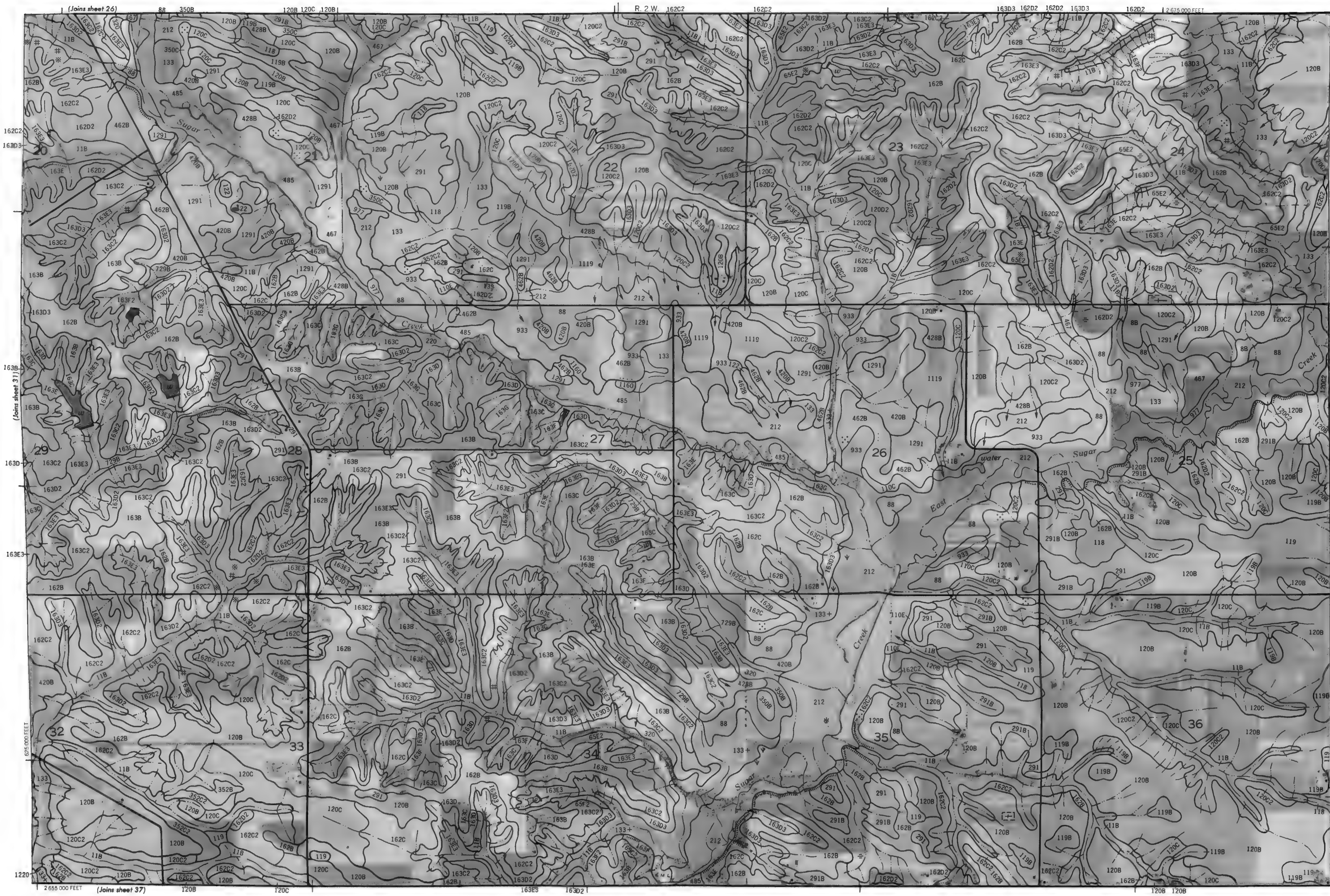
5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:15 840

Coordinate grid ticks and land division corners are approximately positioned.

N

CEDAR COUNTY, IOWA - SHEET NUMBER 32



This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

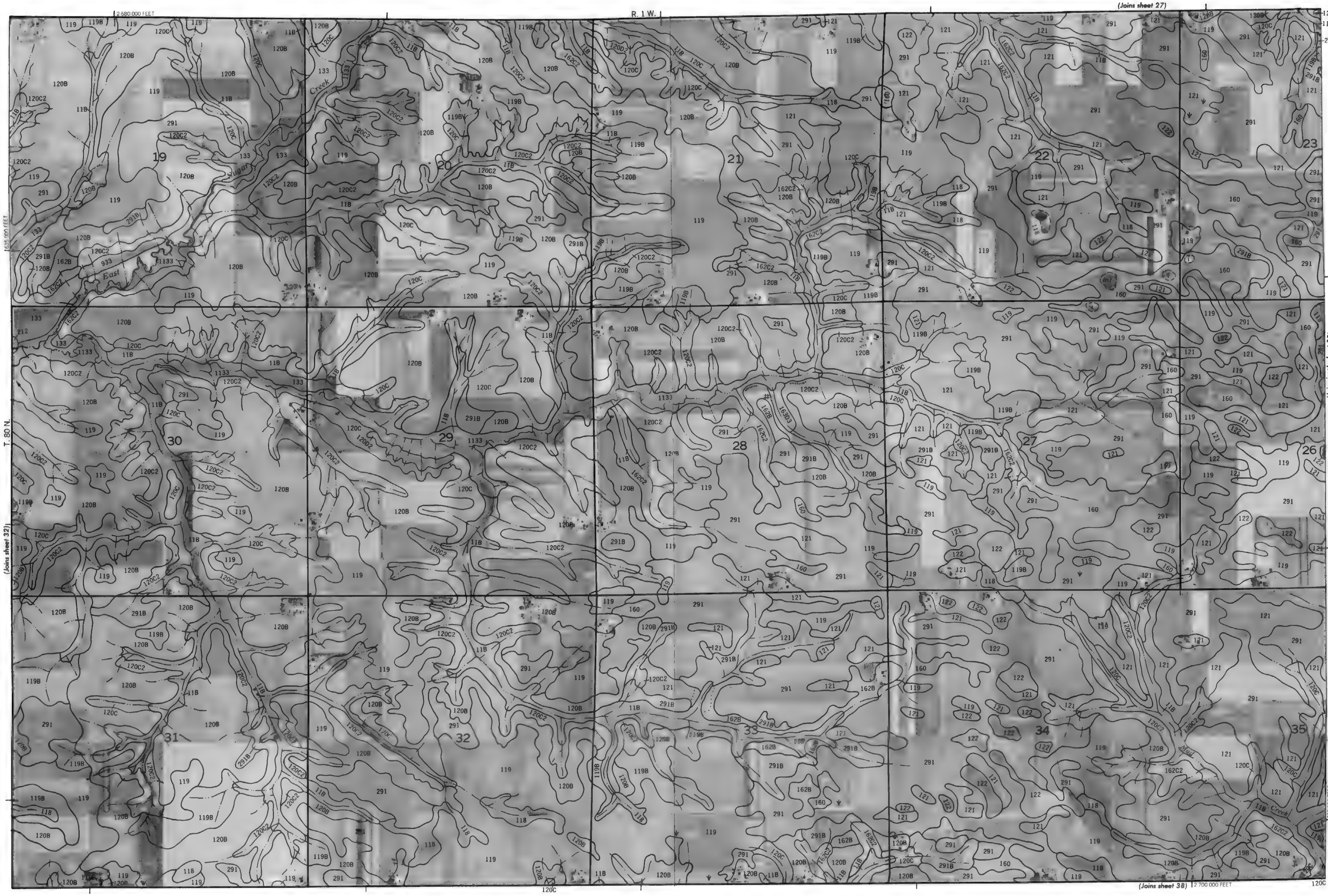
1 ¾ ½ ¼ 0 1 Mile
5000 4000 3000 2000 1000 0 5000 Feet
Scale 1:15840

Coordinate grid ticks and land division corners are approximately positioned.

CEDAR COUNTY, IOWA NO. 32

CEDAR COUNTY, IOWA - SHEET NUMBER 33

N



1 ¾ ½ ¼ 0 1 Mile
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet
Scale 1:15 840

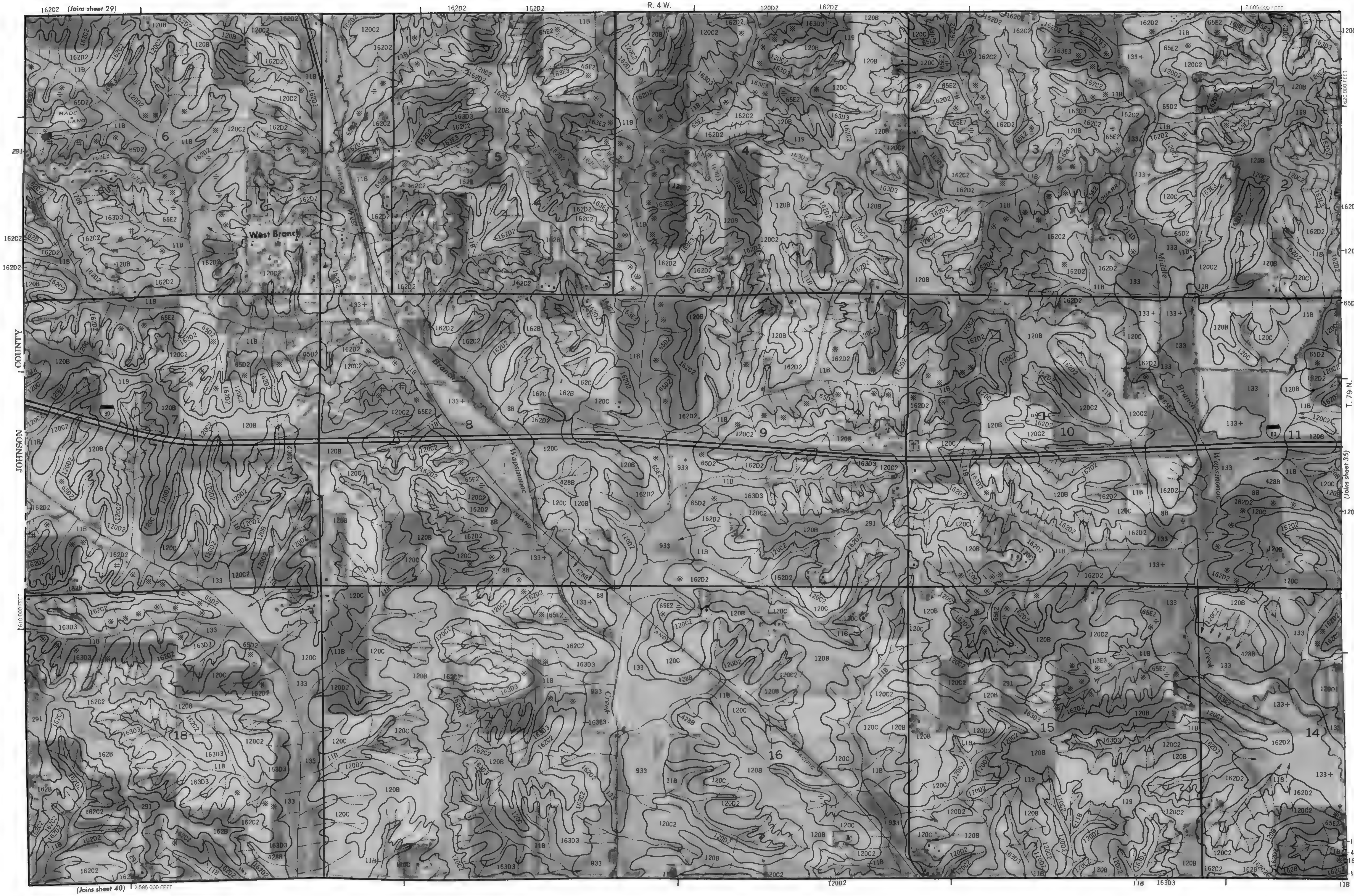
This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

Coordinate grid ticks and land division corners are approximately positioned.

34

N

CEDAR COUNTY, IOWA - SHEET NUMBER 34



This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 Mile ¾ ½ ¼ 0

5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:15840

Coordinate grid ticks and land division corners are approximately positioned.

CEDAR COUNTY, IOWA - SHEET NUMBER 35

35
N

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 Mile
5 000 Feet
Scale 1:15 840

Coordinate grid ticks and land division corners are approximately positioned.

CEDAR COUNTY, IOWA NO. 35

36

N

CEDAR COUNTY, IOWA - SHEET NUMBER 36

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

1 ¾ ½ ¼ 0 1 Mile

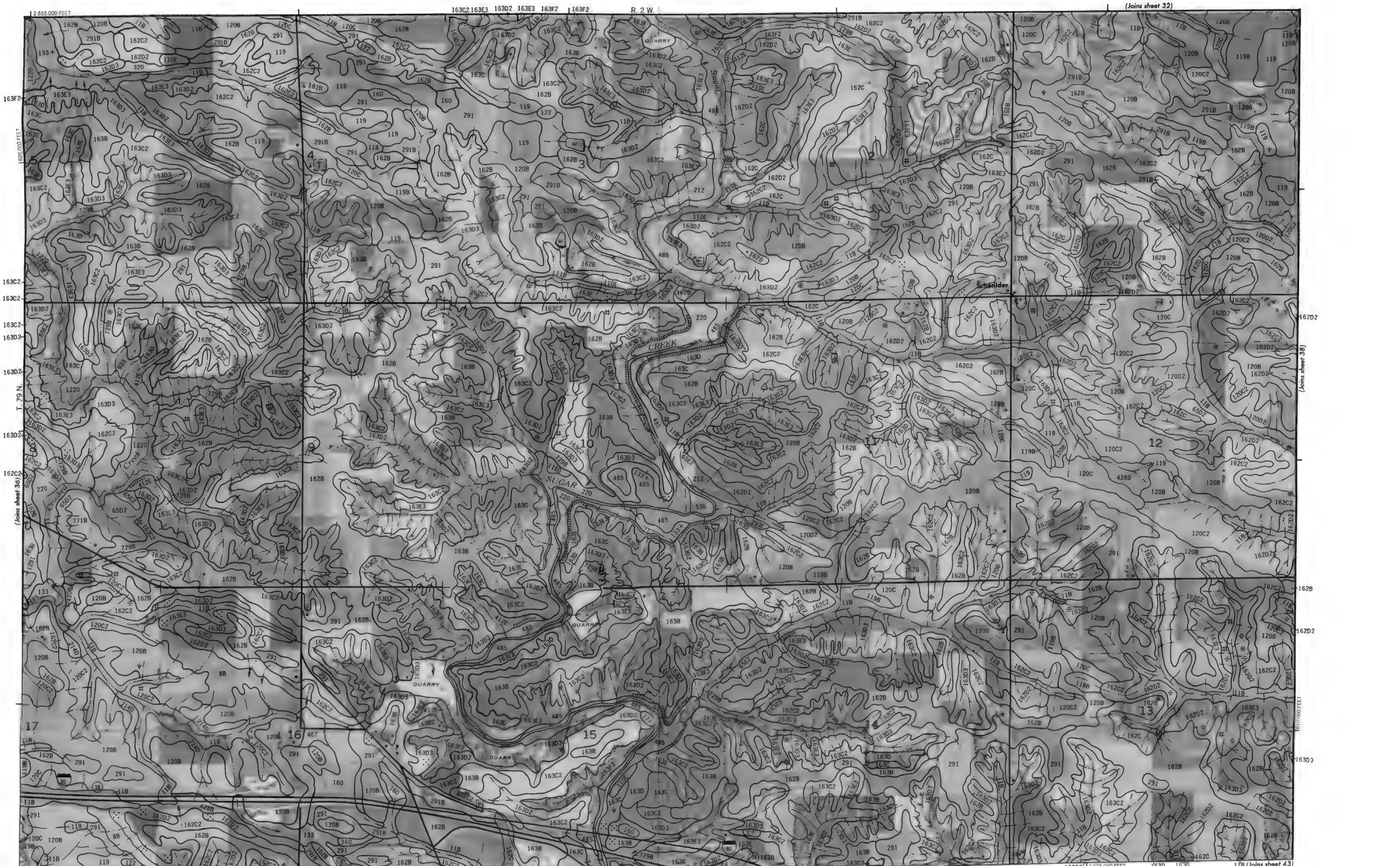
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

Scale 1:15 840

Coordinate grid ticks and land division corners are approximately positioned.

CEDAR COUNTY, IOWA NO. 36

CEDAR COUNTY, IOWA - SHEET NUMBER 37



This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

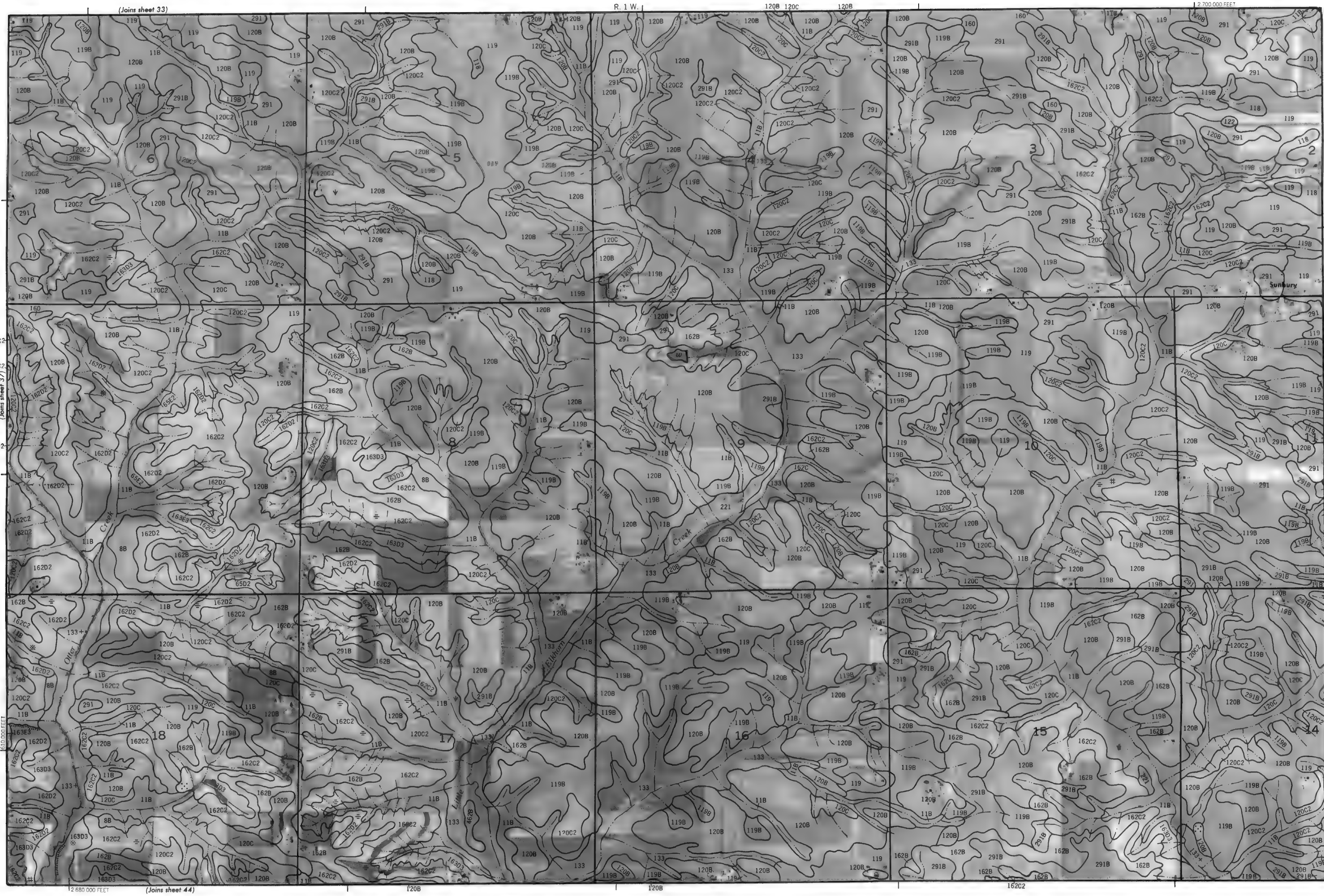
Scale 1:15 840

Coordinate grid ticks and land division corners are approximately positioned.

CEDAR COUNTY, IOWA - SHEET NUMBER 38

38

N



This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

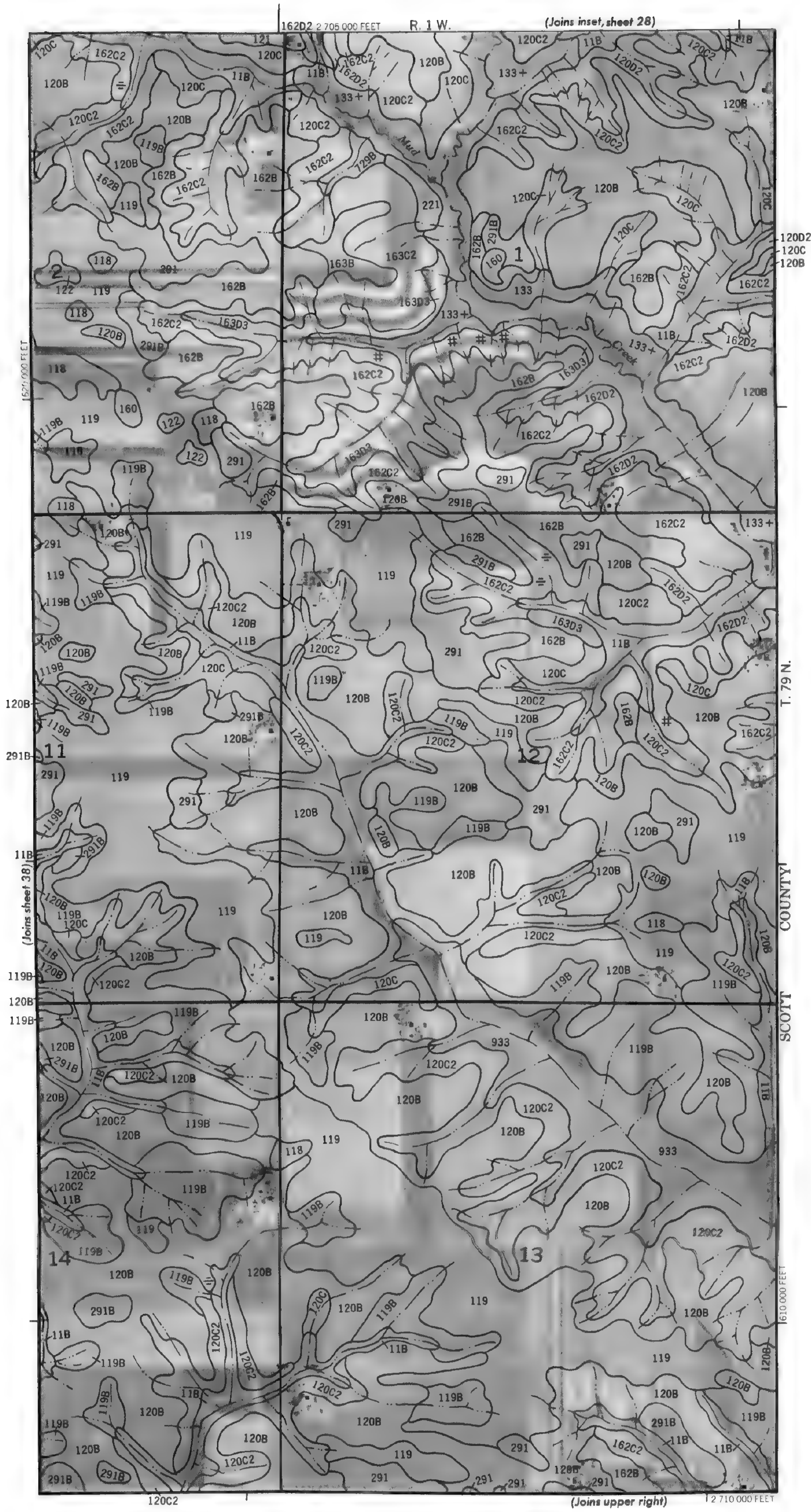
1 ¾ ½ ¼ 0 1 Mile

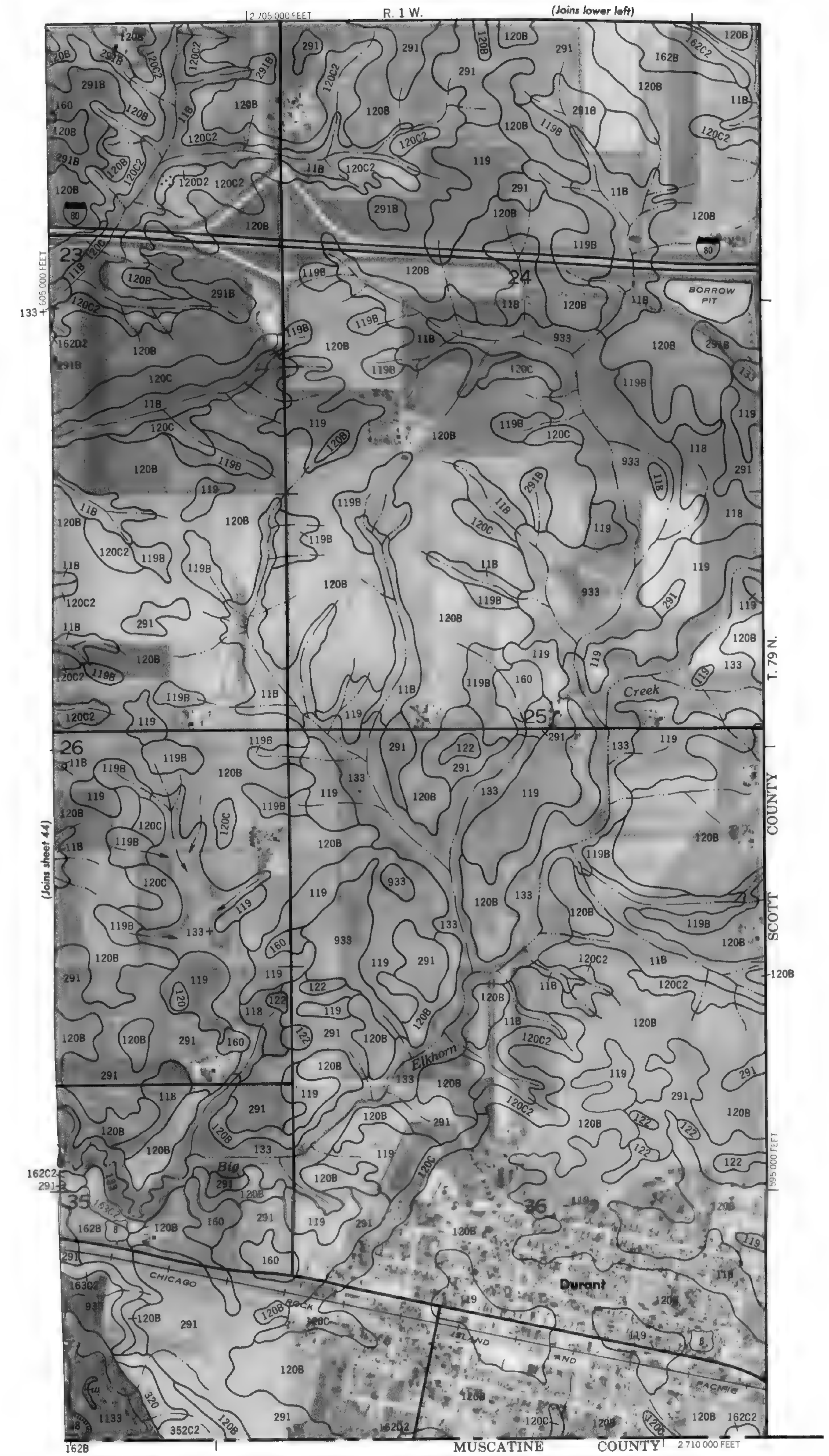
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

Scale 1:15 840

Coordinate grid ticks and land division corners are approximately positioned

CEDAR COUNTY, IOWA - SHEET NUMBER 39





N

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:15840

Coordinate grid ticks and land division corners are approximately positioned.

CEDAR COUNTY, IOWA - SHEET NUMBER 40

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 Mile
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet
Scale 1:15 840

Coordinate grid ticks and land division corners are approximately positioned

CEDAR COUNTY, IOWA - SHEET NUMBER 41

N

CEDAR COUNTY, IOWA NO. 41

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

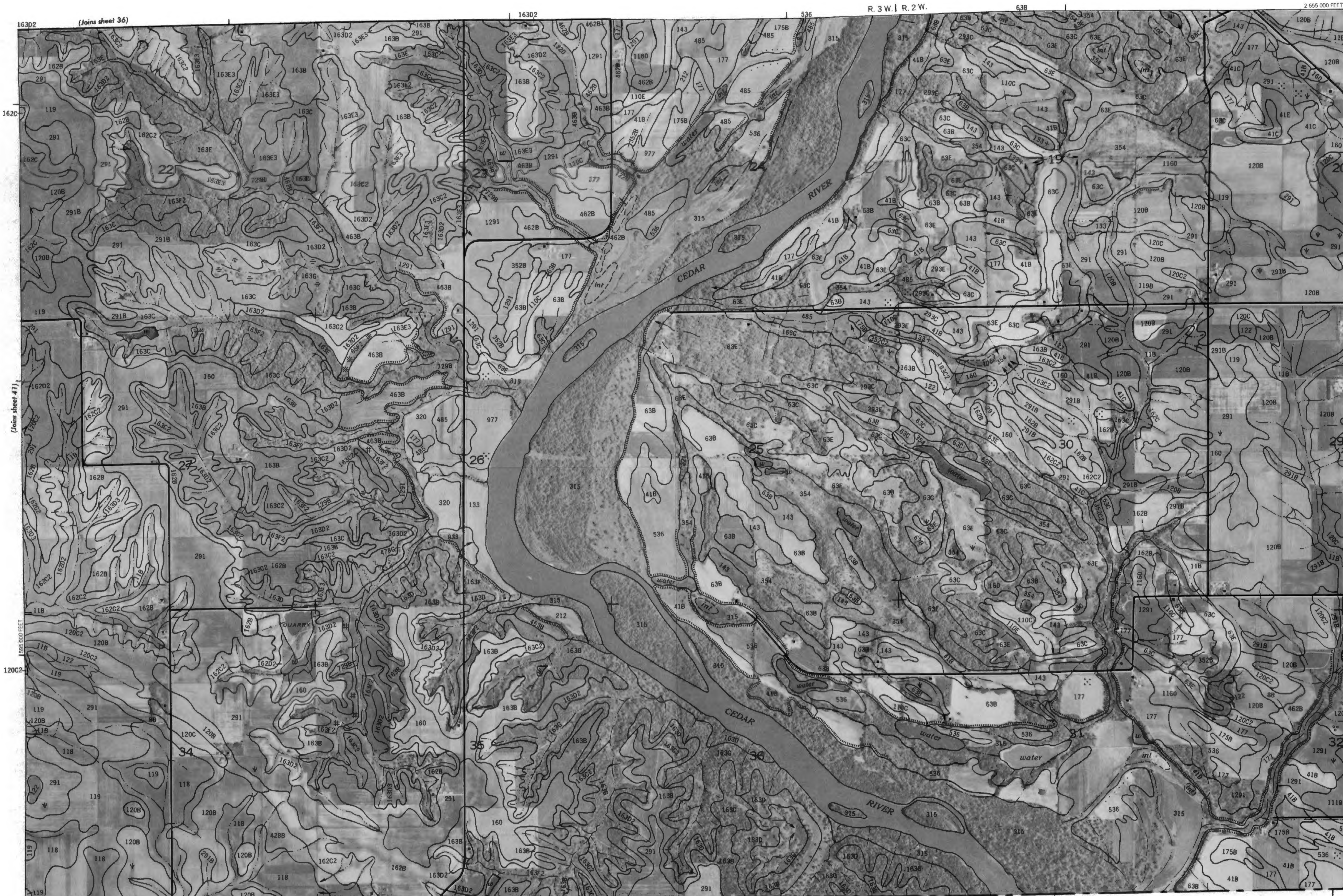
Scale 1:15 840

Coordinate grid ticks and land division corners are approximately positioned.

42

N

CEDAR COUNTY, IOWA - SHEET NUMBER 42



MUSCATINE COUNTY

1 Mile — 0 — 5000 Feet

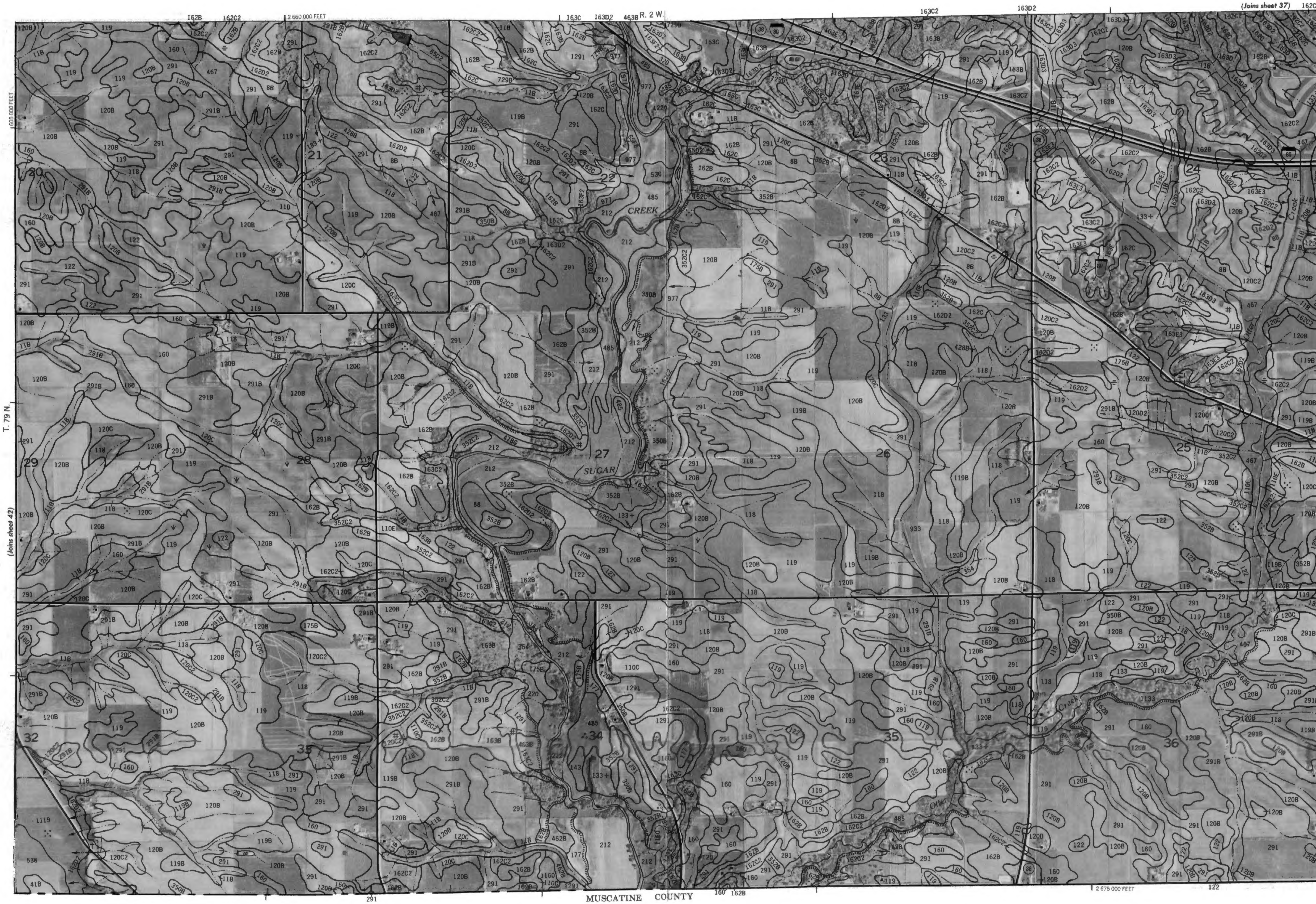
Scale 1:15840

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

Coordinate grid ticks and land division corners are approximately positioned.

CEDAR COUNTY, IOWA - SHEET NUMBER 43

N



This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

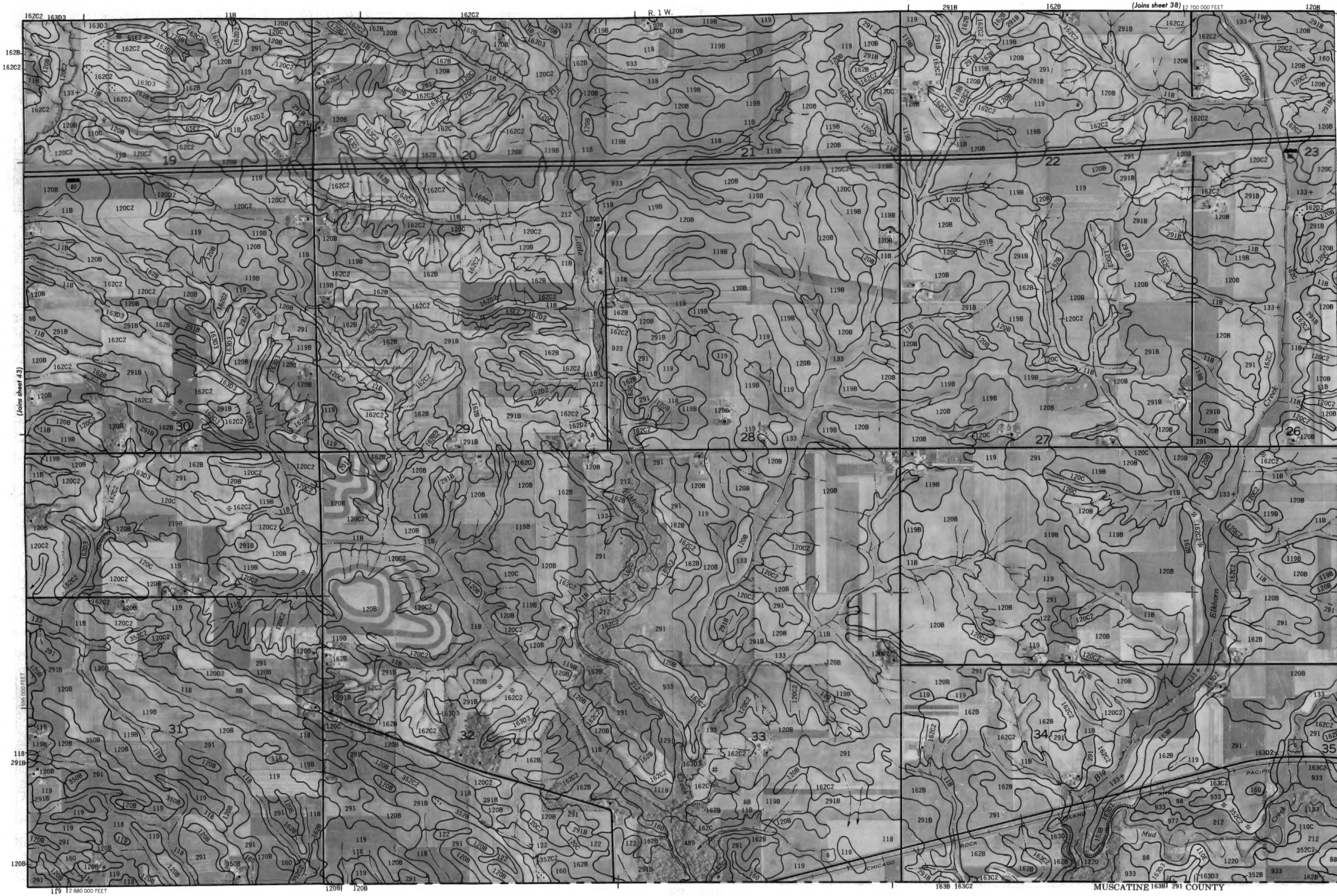
Scale 1:15 840

Coordinate grid ticks and land division corners are approximately positioned.

44

N

CEDAR COUNTY, IOWA - SHEET NUMBER 44



This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:15840

Coordinate grid ticks and land division corners are approximately positioned.

CEDAR COUNTY, IOWA NO. 44